Portable network analyzer

AR6

USER MANUAL

(M98230801-03-14A)

CE

LOG OF REVISIONS

Date	Revision	Description
28-01-2013	12F	Original manual
02-06-2014	14A	Several modifications. LED description in flexible clamps

SAFETY INSTRUCTIONS

Follow the warnings in this manual, which are indicated using the following symbols.

	DANGER: Warns of a risk, which could result in personal injury or material damage.
	WARNING: Indicates that special attention should be paid to a specific point.

	Incorrect connection, handling or maintenance of the unit may result in death, serious injuries or fire hazard. Avoid handling the device while it is connected to the power supply. Follow the installation and maintenance instructions throughout the unit's entire working life. Specifically, follow the recommended installation instructions in the user country's Electrical Code or Regulations. If the unit must be installed in areas with high-voltage (HV) equipment, the personnel involved must be properly trained and authorised to operate in areas with high-voltage risk. Always wear the necessary personal protective equipment.

ATTENTION 	If the instructions preceded by the WARNING symbol are not respected or followed correctly, this could cause personal injury or damage to the unit and/or installations. The unit must be connected to the external power supply using suitable over-current protection device and a switch that can disconnect it from the power supply.

Disclaimer

CIRCUTOR, SA reserves the right to modify the units or their specifications appearing in this manual without prior notice.

The CIRCUTOR guarantee is two years from the purchase date and is limited to refunding the purchase price, free repair or replacement of the defective unit, if the unit is returned to the CIRCUTOR after-sales service within the guarantee period.

CIRCUTOR, SA supplies its customers with the latest versions of the unit specifications and instruction manuals on its website: www.circutor.com.

Recommendations before using the unit

The energy supply must be switched off and the unit disconnected before handling, changing the connection or replacing units.

It is important to only use the original connection cables and accessories that come with the unit. These products are specially designed to be used with this device and meet current safety standards.

The unit manufacturer is not liable for any damage caused by users or installers not complying with the warnings and/or recommendations that appear in this manual, nor for damage caused by using non-original products and accessories.

Inspect the working area prior to installation. Do not use the device in hazardous areas or where there is a risk of explosion. Avoid using the device in damp locations

TABLE OF CONTENTS

LOG OF REVISIONS **2**

SAFETY INSTRUCTIONS **3**

DISCLAIMER **3**

RECOMMENDATIONS BEFORE USING THE UNIT **3**

TABLE OF CONTENTS **5**

1 VERIFICATION UPON RECEPTION **8**

1.1 COMPONENTS AND ACCESSORIES 8
1.2 STORAGE 8

2 DESCRIPTION OF THE UNIT **8**

2.1 INTRODUCTION 8
2.2 DESCRIPTION 9
2.2.1 Active menu *9*
2.2.2 Active measurement *9*
2.2.3 Upper icons *9*
2.2.4 Configuration summary *9*
2.2.5 Date and time *10*
2.2.6 Power button (On/Off) *10*
2.2.7 REC/STOP Button (Log Control) *10*
2.2.8 Validation (ENTER) button *10*
2.2.9 Navigation keys *11*
2.2.10 Buttons for drop-down menus *11*
2.2.11 Icons *11*
2.2.12 Screen *11*
2.3 CONNECTORS 11
2.3.1 Voltage inputs *11*
2.3.2 Current inputs *11*
2.3.3 USB port *11*
2.3.4 Expansion module *12*
2.3.5 Auxiliary power supply *12*

3 INSTRUCTIONS FOR USE **12**

4 TECHNICAL FEATURES **13**

4.1 EXTERNAL POWER SUPPLY 13
4.2 AUXILIARY POWER SUPPLY 13
4.3 BATTERY 13
4.3.1 Rechargeable main power supply battery *13*
4.3.2 Clock power supply internal battery *13*
4.4 CURRENT INPUTS 14
4.5 CURRENT CLAMPS 14
4.6 VOLTAGE INPUTS 14
4.7 UNIT ACCURACY 15
4.8 ENVIRONMENTAL CONDITIONS 15
4.9 MECHANICAL FEATURES 16
4.10 SCREEN 16
4.10.1 LCD features *16*
4.11 MEMORY 16
4.11.1 Log capacity *17*
4.11.2 Memory errors *17*
4.12 ICONS AND SYMBOLS 18

5 START-UP **18**

5.1 BATTERY INSTALLATION 18

5.2 POWER ON 20
6 DROP-DOWN MENUS AND KEYBOARD 20
7 MAIN MENU 21
8 SETTINGS MENU 22
8.1 BIOS CONFIGURATION 22
8.1.1 Language 22
8.1.2 Time to switch off display 23
8.1.3 Contrast 23
8.1.4 Time to lock keyboard 23
8.1.5 Password 23
8.1.6 Phase colours 23
8.1.7 Screen background 23
8.2 CLOCK SETUP 23
8.3 DECIMALS SETUP 24
8.4 USB CONFIGURATION 24
8.4.1 Safe memory access 24
9 SYSTEM INFORMATION MENU 25
9.1.1 Update 25
9.1.2 Recover SD 25
9.1.3 Format SD with a PC program 26
10 MEASUREMENT MANAGER MENU 26
10.1 CREATE 27
10.2 MODIFY 27
10.2.1 Transformer's ratios 28
10.2.2 Measurement configuration 29
10.2.3 Variable selection 30
10.2.4 Events setup (EVQ setup) 31
10.2.5 Transients 32
10.2.6 Trigger interval 33
10.2.7 Periodic trigger 34
10.2.8 Phototriggerconditions using measured data 34
10.2.9 Recordingtrigger conditions 35
10.3 CLEAR 35
10.4 CLEAR ALL 35
10.5 REMOVE 35
10.6 ACTIVATE 35
11 MEASUREMENT ANALYSIS MENU 36
11.1 RECORDS 36
11.2 PHOTOS 37
11.3 DISTURBANCES 38
11.3.1 Disturbance wave shape 38
11.3.2 RMS value of a transient or event 39
11.4 UNIPEDE TABLE 39
11.4.1 Events grouping in accordance with UNIPEDE criteria 40
12 WAVEFORM MENU 41
12.1 PHOTO 42
12.2 PAUSE 42
12.3 RUN 42
12.4 ZOOM IN, ZOOM OUT 42
13 METER MENU 43
13.1 REAL TIME RMS VALUES SCREEN 43

13.1.1 VIEW maximum or minimum values option (consumed or generated) 44
13.2 POWER QUALITY SCREEN 44
13.2.1 VIEW quality maximum or minimum values option 44
13.3 ACCUMULATED ENERGY SCREEN 45
13.4 MAXIMUM DEMAND SCREEN 45
14 PHASORS MENU 45
15 QUADRANTS MENU 46
16 HARMONICS MENU 47
17 CONNECTION DIAGRAMS 49
17.1 THREE-PHASE CONNECTION WITH NEUTRAL 49
17.2 THREE-PHASE CONNECTION WITH NEUTRAL 49
17.3 THREE-PHASE ARON CONNECTION 49
17.4 TWO-PHASE CONNECTION 50
17.5 SINGLE-PHASE CONNECTION 50
17.6 MEASURED / CALCULATED ELECTRICAL PARAMETERS IN ACCORDANCE WITH THE CONNECTION TYPE . 51
18 SCREEN INFORMATION 55
18.1 UPPER BAR ICONS 55
18.2 BATTERY CHARGE 56
18.3 BUTTON PAD LOCK 56
18.4 PHASES CONNECTION 56
18.5 EVENT DETECTION 57
18.5.1 Recording status 57
18.5.2 Memory capacity 57
18.5.3 USB connection 57
*18.5.4 Snapshot ..... **¡Error! Marcador no definido.***
18.6 MENU TREE 58
18.7 SWITCHING OFF THE ANALYZER 59
19 TYPES OF FILES GENERATED 59
19.1 REC.STD FILES 59
19.2 PHO.STD FILE 64
19.3 EQV.STD FILE 64
19.4 LOG.EVA FILES 65
19.5 LOCATION OF LOGS 66
19.6 FILE DOWNLOADING 66
20 SOFTWARE UPDATE 66
21 POWER VISION PLUS 66
22 FREQUENTLY ASKED QUESTIONS 67
22.1 CAN I EXPAND THE ANALYZER'S INTERNAL MEMORY? 67
22.2 THE UNIT IS NOT RESPONDING TO THE BUTTONS. WHAT COULD BE HAPPENING AND HOW CAN I FIX IT? 67
22.3 WHAT DOES THE UNIT LOG WHEN IT TAKES A SNAPSHOT? 67
22.4 WHAT DOES IT LOG WHEN IT CAPTURES THE WAVE SHAPE OF AN EVENT? 67
22.5 WHAT SOFTWARE IS USED TO ANALYSE THE LOGGED DATA? 67
23 MAINTENANCE AND TECHNICAL SERVICE 68
24 GUARANTEE 68
25 CE CERTIFICATION 69

1 VERIFICATION UPON RECEPTION

Check the following points when the user receive the unit:

The unit meets the specifications of the user order.

The unit has not suffered any damage during transport.

Perform an external visual inspection of the unit prior to switching it on

Check that the power supply voltage of the unit is right for the mains to which it is to be connected

1.1 COMPONENTS AND ACCESSORIES

The AR6 analyzer comes with the following:

- AR6 portable network analyzer
- 100...240 Vac / 12 Vdc 3.33 A (40 W max) power supply
- AR6 battery
- 5 voltage measuring cables
- Bag with coloured ties for voltage cables
- 5 crocodile clamps
- USB communication cable
- 4 coloured adhesive connector labels
- “Power Vision plus” software CD
- Manufacturer's Certificate of Production
- User’s manual.
- SD FAT32 memory (inserted in the unit)

	We recommend always using cables and accessories supplied by CIRCUTOR. Otherwise, CIRCUTOR is not liable for potential operation or safety issues

1.2 STORAGE

The unit should be stored according to the following recommendations:

Avoid placing it on uneven surfaces.

Do not store in outdoor areas, humid areas or areas exposed to the splashing of water.

Do not install near hot spots (maximum ambient temperature: 45 ºC)

Avoid saline and corrosive environments.

Avoid storing the unit in areas where a lot of dust is generated or where the risk of chemical or other types of contamination is present.

Do not place any weight on top of the unit.

2 DESCRIPTION OF THE UNIT

2.1 INTRODUCTION

This manual contains all the necessary information for the safe use of the ***AR6***network analyzer and to help the user to get the best performance from it.

AR6 analyzers incorporate the latest technology and offer the most advanced features on the market in the area of measurement and logging of electrical parameters in industrial or residential networks.

Read this manual carefully before connecting the unit in order to avoid incorrect use that may cause permanent damage.

2.2 DESCRIPTION

The ***AR6*** is a portable network analyzer for measuring grid parameters. It is the latest version of the CIRCUTOR S.A. AR 4 and AR 5 portable analyzer series.

It is a digital measuring instrument that takes samples of voltage waves and current and calculates RMS voltage and current values with a specific TMP averaged time. It includes a 1 GB internal memory for storing the data recorded at different installations.

The figure shows the instrument's control buttons and main screen.

Fig.2-1.- Main screen of the AR6

2.2.1 Active menu

The bar at the top shows the name of the screen being displayed.

2.2.2 Active measurement

It shows the name of the file where data are saved in the event this is required by the user.

2.2.3 Upper icons

These icons give analyzer's status information. For more information see the chapter entitled Upper bar icons

2.2.4 Configuration summary

The unit shows a measurement configuration summary window so that the correct configuration of the analyzer can be verified. It displays the following information:

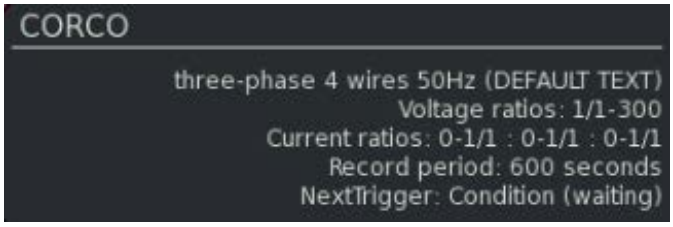

CORCO
three-phase 4 wires 50Hz (DEFAULT TEXT)
Voltage ratios: 1/1-300
Current ratios: 0-1/1 : 0-1/1 : 0-1/1
Record period: 600 seconds
NextTrigger: Condition (waiting)

Fig.2-2.- Window showing the configuration

- ☒ CORCO: Active measurement name
- ☒ Three-phase 4 wires 50 Hz (DEFAULT TEXT). Description of the measurement (by default the unit indicates the type of circuit selected when creating the measurement, indicating DEFAULT TEXT). Users may change the measurement description text.
- ☒ Voltage ratios 1/1 - 300: Transformers ratio for the voltage channel.
- ☒ Current ratios: 100 -1/1 : 0- 1/1 : 0 – 1/1: Transformers ratio for the different current channels. The three blocks correspond to the phase clamps, the neutral clamp and the earth leakage current clamp.
  Phase clamps; 100-1/1 means: 100 is the nominal current of the connected phase clamp; 1/1 indicates that the unit recognises the clamp and auto-configures the scale. The user must manually configure the scale only in the case of multi-scale clamps or primary /5 clamps.
  Neutral clamp; 0-1/1 : 0 means there is no neutral clamp. If used, this block would indicate the parameters of the neutral clamp. 1/1 indicates that the unit is self-configured
  Earth leakage current clamp; 0-1/1 :0 means there is no earth current leakage clamp. If used, this block would indicate the parameters of the neutral clamp. 1/1 indicates that the unit is self-configured
- ☒ Recording period: 600 seconds: That is the configured log period.
- ☒ Next trip: Condition (pending): This indicates if the recording needs a certain trigger condition (parameter threshold or time gap). If it is not configured, the unit will display "disabled"

2.2.5 Date and time

This displays the date and time at when the unit was configured.

2.2.6 Power button (On/Off)

To switch the analyzer ON or OFF, the user must press the ON/OFF button and confirm the action on the menu that appears on the screen.

The button will light up either red or green in colour. The colour green indicates the unit is ON and, if flashing, that it is in energy saving mode, with the screen off. Intermittent red indicates that it is connected to the network and that the battery is charging, and the LED OFF means that the analyzer is switched OFF.

2.2.7 REC/STOP Button (Log Control)

Once the user has configured and connected the unit, its correct connection must be verified by checking the values displayed by the unit. If the connection is verified as correct, the user may begin recording data by pressing this button. Likewise, in case that the user wishes to interrupt an on going recording , this button must be pressed.

2.2.8 Validation (ENTER) button

This is used to run the function selected among the various options from the configuration and display screens, or from the dynamic drop-down menu. It is referred to in this manual with the λ sign.

2.2.9 Navigation keys

The unit has 4 navigation keys. These buttons have arrows drawn on them to indicate the direction of cursor movement. In this manual these buttons are referred to with the ▲/▼, ◄/► icons.

2.2.10 Buttons for drop-down menus

The analyzer function buttons are variable or "dynamic". The options displayed on dropping down the menus for each of the function buttons are, different depending on the current screen.

2.2.11 Icons

The main menu icons help the user quickly and easily access the configuration, system information and display screens. For more information on each of the shortcut icons see chapter 18 entitled SCREEN INFORMATION

2.2.12 Screen

5.7" VGA LCD screen that can simultaneously display data from 9 channels: Voltages *U*1, *U*2, *U*3 , phase to neutral (terminal UN) , *U*N, Neutral voltage referred to earth (terminal U_{EARTH}) and currents *I*1, *I*2, *I*3, *I*N, I_{LEAK}.

2.3 CONNECTORS

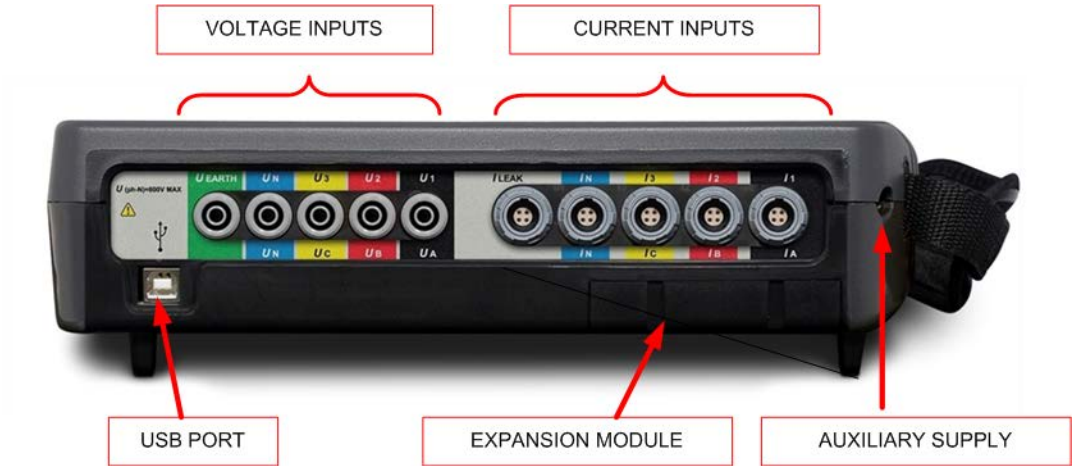


Fig.2-3.- Connections on the top of the AR6

2.3.1 Voltage inputs

The voltage inputs of the AR6 are found on the top part of the unit, as shown in Fig.2-3. They are identified with the symbols U1 (UA), U2 (UB), U3 (UC), UN (UN) and Uearth and identified with different colours (identifier adhesive label may be chosen by the user).

2.3.2 Current inputs

The analyzer's current inputs are also found on the top of the analyzer, as shown in Fig.2-3. This current inputs are identified with the symbols *I*1 (*I*A), *I*2 (*I*B), *I*3 (*I*C), *I*N (*I*N) and I_{LEAK}. The identification colours depend on the identifier adhesive chosen by the user.

2.3.3 USB port

This is a type B USB communications port, used for downloading recorded data. When the analyzer is connected to a computer, the unit is recognized as an external drive, so it is not necessary to communicate with the unit in order to download stored files, simply drag the files to the desired directory of the computer or download them using the PowerVisionPlus® software.

2.3.4 Expansion module

This module is not supplied in standard analyzers. The arrow indicates only the positioning of the slot for possible expansion modules. If the user has purchased a special measurement module to extend the features of the standard analyzer, this is where expansion modules are installed. The features of each one of the expansion modules are found in their respective particular manuals.

2.3.5 Auxiliary power supply

This is the slot for the AR6 power supply connector. See the power supply features in chapter 4, entitled TECHNICAL FEATURES.

3 INSTRUCTIONS FOR USE

The ***AR6 analyzer*** is a configurable measuring instrument that may be used in different ways, which the user may select by means of different menu choices. It allows configuration of different measuring methods, various recording times and log and trip conditions. Functions like snapshots, averaging, rebooting maximum and minimum values display, wave shapes display, rate of harmonic distortion, active and reactive power, both inductive and capacitive, energy consumed and generated, among many other parameters can be displayed and/or recorded.

In order to ensure correct operation, carefully read the instructions given in this manual before beginning measurements.

WARNING: Read this manual before using the analyzer.

If the analyzer is used in a manner other than that specified by the manufacturer, its protection may be compromised.

4 TECHNICAL FEATURES

4.1 EXTERNAL POWER SUPPLY

An external alternating current power supply comes with the unit. It may be used to power the unit while recording or to recharge the battery.

Rated voltage	100…240 Vac
Power supply frequency	50…60 Hz
Output voltage	12 Vdc
Current	3.33 A
Max. power	40 W

4.2 AUXILIARY POWER SUPPLY

Rated voltage	12 Vdc
Current	2 A
Maximum power	24 W
Consumption	30 VA

4.3 BATTERY

The ***AR6*** has a built-in Nickel-Metal Hydride battery for the unit's main power supply which gives it autonomy of operation and logging. It also has another internal Lithium battery that permanently powers the internal clock.

4.3.1 Rechargeable main power supply battery

BATTERY	NiMH (Nickel-Metal Hydride)
Voltage	6 V
Capacity	4,200 mAh
Charge time	2 to 3 h
Battery life while in use	4hrs with LCD on
	8hrs with LCD off

4.3.2 Clock power supply internal battery

Lithium battery	CR2025
Voltage	3 V
Capacity	600 mA/h
Battery life without charging	10 years

4.4 CURRENT INPUTS

Inputs for current measurement	*I*1 *I*2 *I*3 *I*N *Leakage*
Input voltage	0…2 V_{RMS}
Measurement margin	from 1 to 120% of *In*
Primary current measurement *I*n	Depends on clamp
Admissible overload	3 *In*
Consumption	≤0.0004 VA
Accuracy of the instrument (excluding the clamp)	0.5%± 1 digit (we must add the margin of error of the clamp used to this number)
Special features	Earth leakage current measurement via low-pass filter (option to activate or deactivate)
Input impedance	10 kΩ

4.5 CURRENT CLAMPS

The AR6 can use single-scale or multi-scale clamps. When using single-scale clamps the instrument automatically recognises the clamps connected to it; in the case of multi-scale clamps, when the clamps are connected a menu pops up to configure the current transformer's ratio (see current clamp configuration).

When using E-FLEX 54 cm multi-scale clamps the scales are as indicated in

Table 4-1

Table 4-1.- E-FLEX 54 cm clamps

Clamp	TURNDOWN RATIO	LED	Range (2.5...100%)
E-FLEX 54 cm (See note 1)	200 A	blue	5…200 A
	2,000 A	red	50...2,000 A
	20,000 A	blue + red	500...20,000 A

Note 1: E-FLEX clamps have built-in LEDS to indicate the scale at which they are working. When they work at a low scale the blue LED lights up, when they work at a medium scale the red LED lights up and when they work at a high scale both LED light up.

4.6 VOLTAGE INPUTS

Inputs for voltage measurement	*U*1 *U*2 *U*3 *U*N U_{EARTH}
Input margin	*Unom*= 10 to 800 V_{RMS} phase-neutral
Measured accuracy	0.5%± 1 digit
Number of inputs	5
Peak voltage	2,500 Vpeak
Bandwidth	3.2 kHz
Input impedance	10 MΩ

Permanent overvoltage	1,000 V_{RMS}
Transitory overvoltage <1 s	2,500 Vpeak
Absolute maximum voltage	6 kV
Consumption	≤0.04 VA
Maximum voltage in the voltage measurement circuit	
1000 V CAT III / 600 V CAT IV for elevations below 2000 m.	
1000 V CAT II / 600 V CAT III / 300 V CAT IV for above 2000 m	

4.7 UNIT ACCURACY

Variable	Resolution	Accuracy	Margin
Currents * (2 V input)	0.1 mA	± 0.5%	10% … 120% of *I*n
Voltage	0.01 V	± 0.5%	20% … 120% of *U*n
Active power	0.1 W	± 1%	
Reactive power	0.1 VAr	± 1%	
Apparent power	0.1 VA	± 1%	
Frequency	0.01 Hz	± 0.01 Hz	45 … 65 Hz
Active Energy	1 W·h	± 1%	
Reactive energy	1 VAr·h	± 1%	
Voltage THD	% x 10	± 0.5%	10% … 120% of *U*n
Current THD	% x 10	± 0.5%	20% … 120% of *I*n
PST Flicker	% x 10	± 5%	
Voltage Imbalance	% x 10		
Voltage Asymmetry	% x 10		
Crest Factor	x100	± 0.5%	1.0…1.875

* The unit's accuracy in current and in power does not include the margins of error of the clamps connected to it.

4.8 ENVIRONMENTAL CONDITIONS

Operating temperature	-10…+50 ºC
Storage temperature	-10…+60 ºC
Altitude	2,000 m
Humidity without condensation	5...95%

4.9 MECHANICAL FEATURES

Outer dimensions	283 x 168 x 80 mm
Weight	1.640 kg

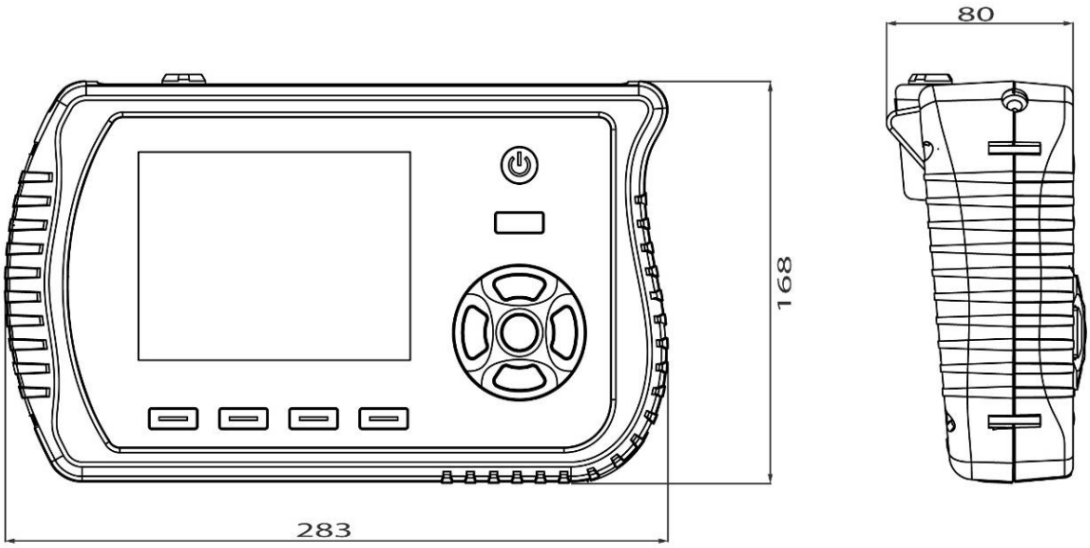


Fig.4-1.- Dimensions

4.10 SCREEN

4.10.1 LCD features

Panel size	5.7”(diagonal measurement)
Active area of the LCD	Width 116.16 mm x Height 87.12 mm
No. of Pixels	Horizontal (640x3) x Vertical 480
Resolution type	VGA
Pixel size	Horiz. 0.1815 mm x Vert. 0.1815 mm
Pixel colour	RGB vertical lines
Display colour	White
No. of colours	262K
Back lighting	LED

4.11 MEMORY

	The internal memory must be handled with all possible precautions to prevent files from being corrupted. Switch the instrument OFF to remove it.

The unit has an internal SD memory. It is not designed so that users must remove the memory to read the data logged on it, as the data can be accessed and downloaded using a USB cable. Users may change the unit's memory for one with greater capacity if necessary. **It is very important that the new memory card have the same folder structure as the one being changed and be in FAT32 format.**

Table 4-2 shows a list of some valid cards and their features.

Table 4-2.- Compatible card models

Model	Features
SD	1.10 standard specification Capacity up to 32 GB
SHDC	2.0 specification, class 4 Minimum transfer speed of 4 MB/s Capacity of up to 32 GB

4.11.1 Log capacity

The standard AR6 log for a 4-wire, three-phase system, saving all variables, occupies 4,230 bytes and the log header occupies 1,586 bytes (approx. 2 kb). Therefore, the log capacity can be calculated using the following approximation:

N. of logs = (SD memory capacity in Mb * 1000 - No. files *2)/ 4.23

Log hours in 1 file = (SD memory capacity in Mb * 1000 - 2) * log period in seconds / (3,600 * 4.23)

4.11.2 Memory errors

It may occur that for reasons unrelated to the unit some memory partitions become inaccessible or corrupt and the information stored in those memory sectors is lost. If the unit detects a write access problem in log mode that prevents data from being logged to memory it will stop the log automatically and warn the user that there is an access problem using the following alert. It will also remove the SD memory detection icon from the upper menu.

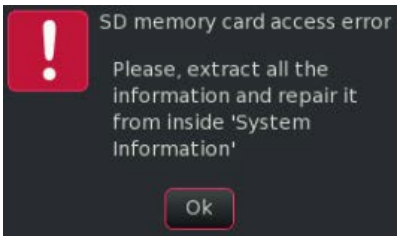


Fig.4-2.- Memory access error

If the user accepts the warning but does not retrieve the card using the "Retrieve SD" tool in the system's information menu and instead tries to log, the unit will show the following warning as a reminder.

Recording not allowed
SD memory card access error
Please, extract all the information and repair it from inside 'System Information'
Ok

Fig.4-3.- Memory access and retrieval error

4.12 ICONS AND SYMBOLS

Double insulation Protection class identifier.

Manufactured in Europe. Under European standards.

These products have been designed and manufactured with top quality components that can be recycled and reused.

Electrical and electronic products contain substances that can harm the environment if they are not adequately treated.

This symbol means that electrical and electronic units should not be disposed of with other household waste at the end of their useful life.

Please take the obsolete products being replaced to a waste collection point or contact the user local government.

The European Union has established specific collection systems for electronic and electrical unit waste.

REI-RAEE Record No.: **3338**

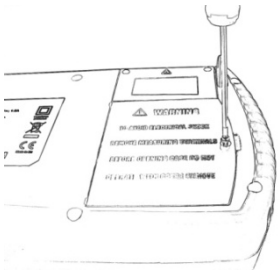
5 START-UP

5.1 BATTERY INSTALLATION

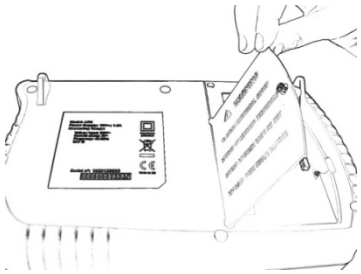
The analyzer comes without the battery installed in order to ensure its good condition. The user must install the battery before taking any other step. To do this, the procedure below must be followed.

Once installed, we recommend fully charging it for a minimum of 6 hours. Do the same when replacing the unit's battery with a new one.

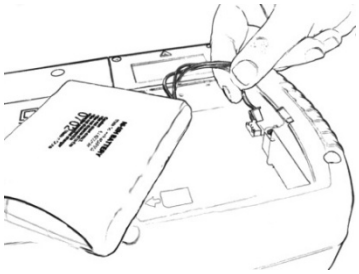
	In order to install the battery, the unit must be disconnected from any external power supply. Also, the input terminals of the measuring circuit must be disconnected.



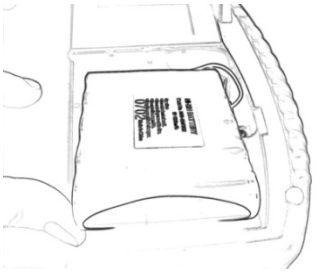
1.) Remove the screw from the battery cover.



2.) Lift the cover to make the battery compartment accessible.

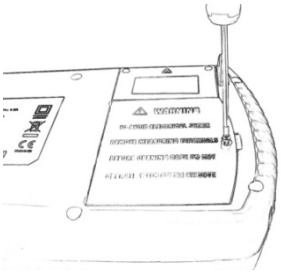


3.) Insert the battery cables and connector in the receptacle indicated for the battery. Make sure that the connector is positioned correctly, and do not force it.



4.) Once the battery is connected to the unit, position it so that the power supply cables are not stretched, compressed, and will not be damaged by the cover.

5.) Install the cover after verifying that none of the cables have been damaged and that the battery is firmly in place.



6.) Lock down the cover again with the screw

Fig.5-1.- Steps to insert / replace the battery

5.2 POWER ON

Once the battery has been installed, press the POWER button and hold it down for a few seconds. The analyzer will start-up showing the home screen and giving access to the main menu.

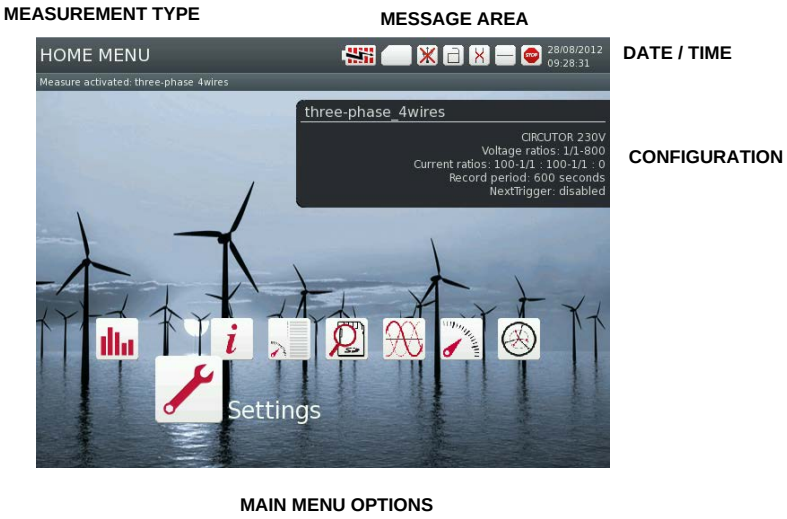
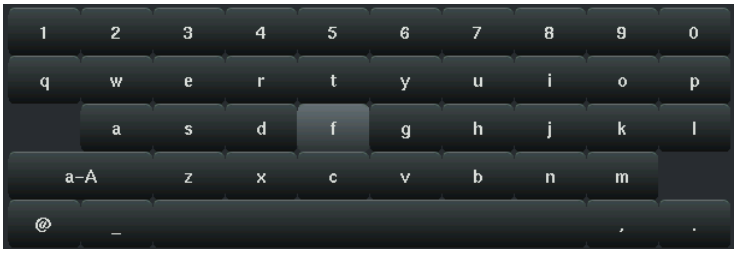


Fig.5-2.- Home screen

6 DROP-DOWN MENUS AND KEYBOARD

To change the value of a field, enter it and click the ENTER key (identified in the following paragraphs as λ). This opens the virtual keyboard or the possible configuration options for the field and allows the user to enter any value or text, depending on each case. The keys or options displayed will be different depending upon the field to be configured.

Alphanumeric:

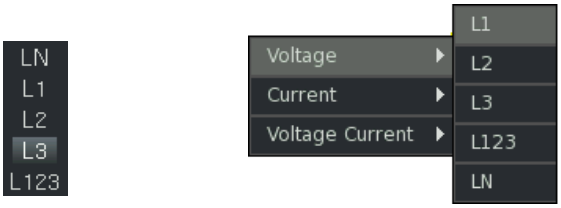


Numeric:

Date:

Time:

Selection:



The arrow buttons ◄/ ► and ▼/ ▲ move the selection cursor to the desired menu option. Theλ button is used to confirm the selection and change to the desired display screen.

The options to cancel, delete or confirm entered values are activated by means of the dynamic function keys, which functions are displayed at the bottom part of the corresponding screen.

7 MAIN MENU

The main menu of the AR6 has various icons that indicate the different configuration and display options available to the user in a simple and intuitive manner.

Fig.7-1.- Main menu

The main menu icons are:

SETTINGS

SYSTEM INFORMATION

MEASUREMENT MANAGER

MEASUREMENT ANALYSIS

WAVEFORM

METER

PHASORS

QUADRANTS

HARMONICS

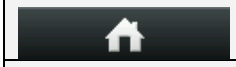
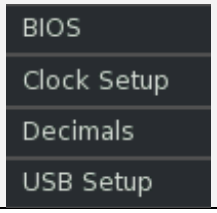
Fig.7-2.- Main menu:

To configure the unit, select first the SETTINGS menu.

8 SETTINGS MENU

The “Settings” menu allows the selection of logging and display parameters of the analyzer .

The dynamic menu options for the configuration menu are:

Button	Function	Description
	Main Menu	Brings up the main menu
		Allows saving changes to the configuration or restore the default values.
		Configuration options: When the user enter

The basic menu has four screens, selectable with the dynamic key GO TO :

- BIOS configuration
- Clock setup.
- Decimals
- USB configuration

8.1 BIOS CONFIGURATION

When the BIOS configuration options selected, the screen in Fig.8-1 appears. This screen allows configuration of most of the common aspects of the unit. This configuration is maintained for all screens and logs. The configurable items in the BIOS configuration screen are described below

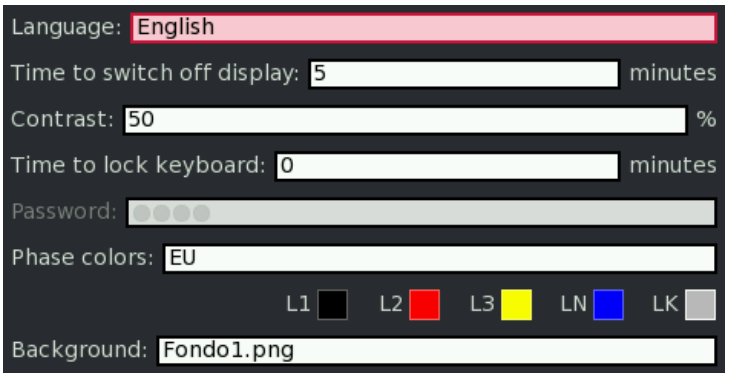


Fig.8-1.- BIOS configuration screen

8.1.1 Language

This field is to select the language for the unit menus and messages.

8.1.2 Time to switch off display

This field is to select the time during which the screen will light after the last change. Once this time has elapsed, the screen will switch OFF and go into a low power status to increase battery autonomy and life. In this status, the Power ON/OFF button will be flashing in green.

8.1.3 Contrast

This field is to select the screen contrast. This field is given in %. A correct configuration can extend battery autonomy and life.

8.1.4 Time to lock keyboard

This field is to select Enter the desired time, in minutes, after which the button pad will lock. If this function is not desired, enter a zero (0) value.

8.1.5 Password

This field is to select a password, if used. Enter a 4-figure password which will be used to unlock the unit's button pad once the locking time has elapsed.

8.1.6 Phase colours

The AR6 has colour templates to identify the phases. The available names and colours are shown in the following table:

Table 8-1.- Options of colour codes to identify phases

	L1 / A	L2 / B	L3 / C	LN / N	LK / K	earth
EU	black	red	yellow	blue	grey	green
UK	red	yellow	blue	black	grey	green
CA	red	black	blue	white	grey	green
USA	black	red	blue	white	grey	green

8.1.7 Screen background

The user can change the screen background using this option of the menu. The selected image will be used as background for all screens.

8.2 CLOCK SETUP

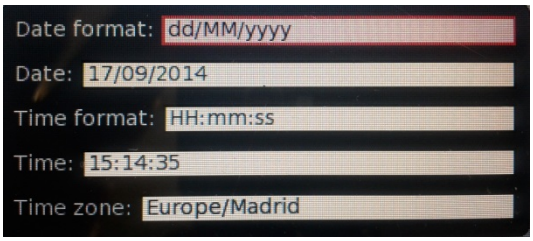


Fig. 8-2.- Clock configuration

Displayed parameters:

The "Clock setup" options allow the configuration of the date and time format and the desired date and time.

It also allows the selection of time zone.

	WARNING !Changing the unit time will cause all the data logged on the memory to be erased

8.3 DECIMALS SETUP

On this screen the user can select the units of measurement and the number of decimal places to be displayed.

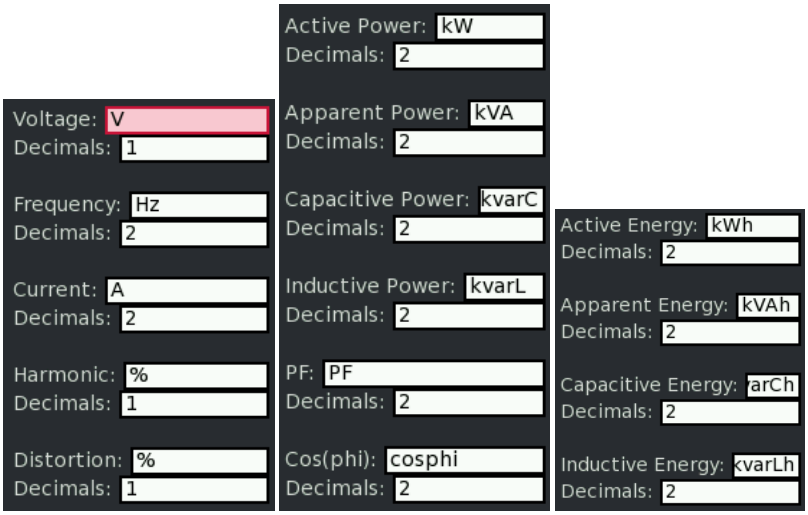


Fig.8-3.- Configuration of the number of decimal places

NOTE: Notice that in the harmonics option the user can select between % (to view the percentage of each harmonic with respect to the fundamental) or V/I (to view the value of voltage or current represented by each harmonic)

8.4 USB CONFIGURATION

This option allows the user to enable or disable the AR6's connection to a computer through the USB channel

8.4.1 Safe memory access

The unit has an internal memory card that stores the logs and parameters for the different measurements created by the user. To safely access the information on the internal memory follow these steps:

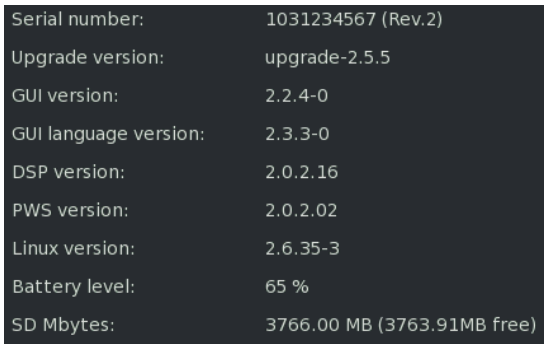
1. Activate the analyzer's USB-B port in the USB setup menu (**The port must be enabled and in file mode)**
2. Connect the USB cable to the computer and the analyzer
3. Access the memory contents from the computer
4. Use the Safe Eject option to disconnect the disk drive that corresponds to the analyzer from the computer.
5. Disconnect the USB cable
6. Disable the analyzer in the USB-B port (from the *USB Configuration* menu)

**** The unit automatically disconnects file mode when the user leave this screen.***

	Not using the Safe Eject option to remove the analyzer's memory unit can cause irreparable damage to the information contained on the memory or lock out the unit; in this case the user must switch off the unit to get it back again.

9 SYSTEM INFORMATION MENU

The information screen shows a summary of the unit's most important data, such as: serial number, memory status, internal firmware versions, etc.

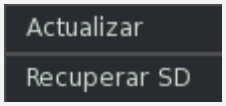


Viewed parameters:

- Analyzer serial number
- Installed update version
- Processor and software versions (GUI, DSP and PWS) and language.
- Software version (Linux)
- Battery charge level
- Available and total system capacity

Fig.9-1.- System information

The dynamic menu options for this screen are:

Button	Function	Description
	Main Menu	Brings up the main menu
		Update: Allowing updating of the device software. Recover SD: Allows memory card data to be recovered if a problem is detected.

9.1.1 Update

The unit copies the *.bin file of the new firmware to be saved on the unit. A process bar indicates the update status on the unit's screen.

9.1.2 Recover SD

This action should be performed if data loss is detected during logging. If the user need to delete the information from a log the user must use the "*clear measurement* or "*clear all measurement*" functions explained in sections 10.3 and 10.4

When the user select Recover SD, all the content on the card and the instrument's internal memory will be deleted. The actions performed by the analyzer are:

- Delete the memory card partitions
- Generate partitions
- Format the card in FAT32 format
- Restore the internal memory.

The unit displays the following warning when this option is selected.

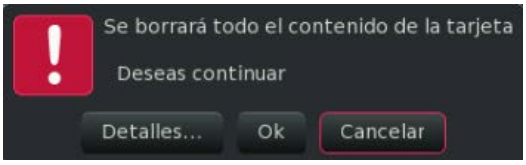


Fig.9-2.- Warning screen

If "Details" is selected, the unit indicates a PC tool to format the unit's SD card and the configuration that should be used. (see section 9.1.3)

9.1.3 Format SD with a PC program

This action should be performed if problems are detected when accessing the SD memory. The indicated tool is used to restore the card with its factory-installed values and partitions, recovering the areas with access or write problems (corrupt areas).

The recommended tool to format the SD card is "SD Formatter", available at www.sdcard.org/downloads" with the following options activated:
Format Type: Full (OverWrite)
Format Size Adjustment On

10 MEASUREMENT MANAGER MENU

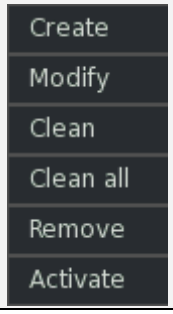
The measurement administrator screen allows the user to create standard templates in order to configure the unit simply and rapidly for data acquisition and recording. To start this menu, select the icon in the figure at the left and click the ENTER button , ●

Fig. 10-1.- List of measurements

The screen displays a list of the various measurement files created on the unit. Only one of these measurements may be active at any given moment. The figure shows a list of measurements as an example; "test" appears marked with a square with a dot in it, indicating that this is the active measurement.

One measurement allows configuration of the analyzer for measuring and logging in a specific installation.

The options for the dynamic ACTIONS button on this screen are:

Button	Function	Description
	Main Menu	Brings up the main menu
		The options of this menu are to create new measurement files, modify existing ones, delete (clean) files associated with an already existing measurements or the files of all the existing measurements, permanently delete a measurement or activate it. They are all explained in more detail below

10.1 CREATE

To create a new measurement file the user must enter the name for the measurement. To configure it, the user must select it among the available templates, or if necessary select a measurement from those previously created as templates. To do so, select the *Templates* option from the VIEW menu.

Fig. 10-2.- Creation of a new measurement

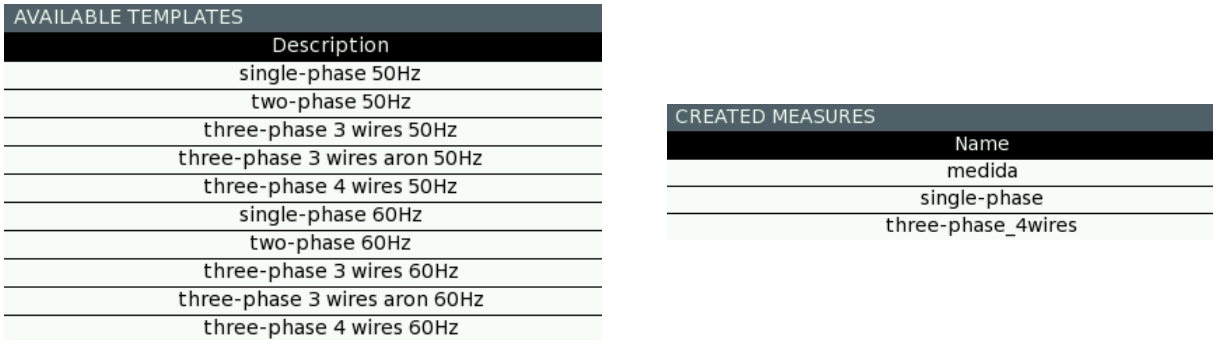
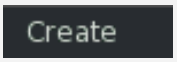
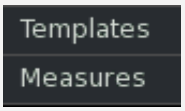
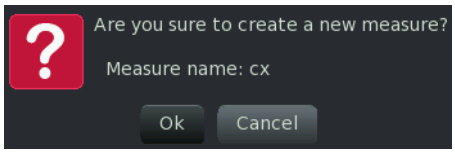


Fig.10-3.- Previously created templates and measurements

The options for the dynamic ACTIONS button for this screen are:

Button	Function	Description
	BACK	Brings up the previous screen.
		Enables confirmation of the creation of a measurement.
		To create a new measurement, select from among the AR6 default templates or any of the measurements previously created by the user.

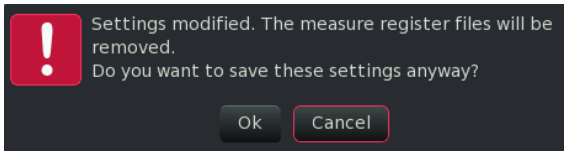
Once a name for the new measurement has been entered, select CREATE. The analyzer displays a confirmation window before creating the measurement. Once created, the current clamps and voltage transformers ratio configuration screen is displayed.	

10.2 MODIFY

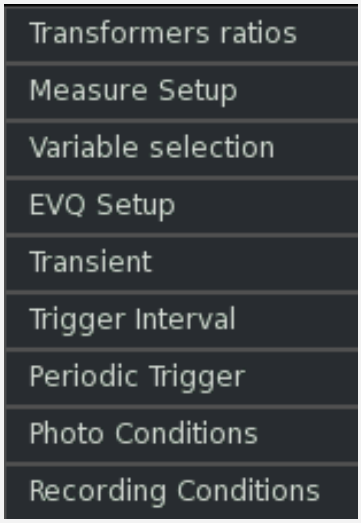
The unit allows modification of the measurements created at any time, whether it is the active measurement or another from the list of measurements.

	Editing the active measurement implies the deletion of all the files previously generated by the measurement. (The analyzer will ask for confirmation of the edition process in order to prevent the user from deleting data accidentally)

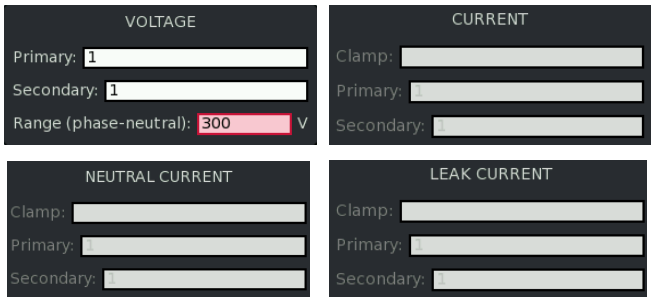
When trying to modify the active measurement, the unit warns the user with the following confirmation message. It is important to read the warnings, as they indicate the deletion of data stored in the memory for that measurement.



The dynamic ACTIONS button for all the modification screens offers the options indicated in the GO TO menu:

Button	Function	Description
	BACK	Brings up the previous screen.
		Select in order to save the changes
		TRANSFORMER'S RATIOS: Ratios of transformers used MEASUREMENT SETUP: Circuit, recording time, THD calculation and Maximum Demand. VARIABLE SELECTION: Selection of the variables to be logged. EVQ SETUP: Detection of quality events *.EVQ TRANSIENT: Transient detection TRIGGER INTERVAL: Recording period (start and stop time) PERIODIC TRIGGER: Repeated periodic recordings PHOTO CONDITIONS: Conditions for snapshot capture *.PHO RECORDING CONDITIONS: Conditions to start logging based on electrical parameters.

10.2.1 Transformer's ratios



Configurable Parameters:

- Primary and secondary voltage
- Voltage turndown ratio
- Scale of the clamp installed on the phase meter.
- Scale of the clamps on neutral meter.
- Scale of the earth leakage current clamps

Fig.10-4.- Transformer's ratios configuration screen

The unit lets the user configure the voltage transformer ratios as well as the full scale voltage. The correct configuration of this full scale value enables the unit to work with maximum accuracy.

When the unit detects that the current clamps are connected it shows the configuration screen for the voltage transformers and current sensors. The unit detects the ratio of the

connected current sensors and shows their scale. If multi-scale sensors are connected, the user must select manually the desired one. The analyzer shows one by default. The current ratios can also be modified if the user is measuring at the secondary of a 5A transformer with 5 Ampere clamps, but wishes to view the values measured with respect to the primary of the installation. Similarly, the ratio by default of the voltage transformer is 1/1. If this is not the case, the primary and secondary voltages must be programmed for the voltage transformers.

	The device recognises single-scale current clamps and configures them automatically. The AR6 only allows configuration of the current transformer's ratio if it detects multi-scale clamps or 5 A primary clamps. For all other cases, it automatically recognises the clamps and configures the current scale

10.2.2 Measurement configuration

Configuring a measurement involves the creation of a folder where all the configuration files and data records will be saved.

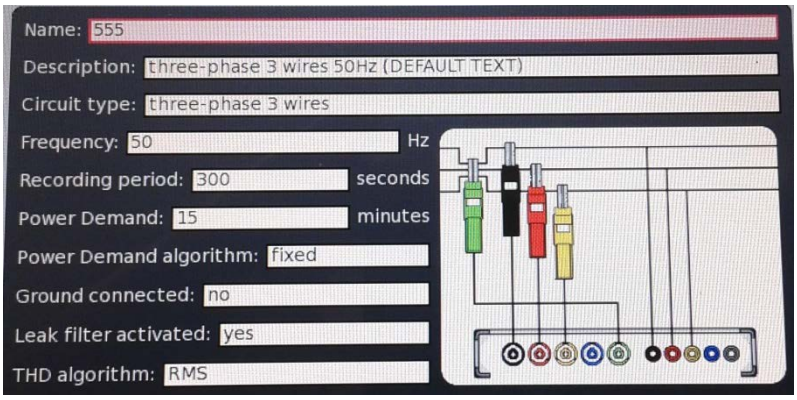


Fig.10-5.- Measurement configuration screen (Example)

The configurable fields on the Measurement screen are:

Table 10-1.- Configurable fields on the measurement screen

Option	Description
Name	Name of the measurement.
Description	Description of the measurement. Lets the user indicate specific data to facilitate locating or referencing the measurement.
Circuit type	Indicates the configuration of the measurement. The user can select between: • Single-phase • Two-phases • Three-phases, 3-wire • ARON three-phase, 3-wire • Three-phase, 4-wire
Nominal frequency [50…60 Hz]	Nominal frequency of the network where the measurement is being taken. The user can select 50 or 60 Hz
Log period [1…7,200 seconds	The log period for the electrical parameters (in seconds). This period is commonly used as averaging period for the variables.
Maximum demand [minutes]	In this field the user should program the energy integration time to perform the Maximum Demand calculation.

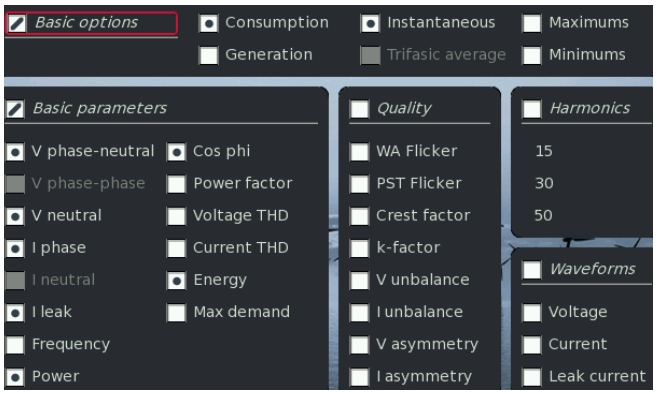
Maximum Demand calculation algorithm	This field allows the user to program the integration periods to obtain Maximum Demand (kWh in a certain period). There are two programming options: a) Juxtaposed consecutive periods (fixed) or b) Scrolling window (sliding)
Ground connection	This lets the user select if the measurement is taken with the earthing cable connected or not. **Erroneous configuration of this section will cause measurement errors**.
Leakage filter connected	Activates a high-frequency filter in the measurement. Useful for checking the difference in value of leakages seen through a filtered earth leakage relay (such as the immunised relays manufactured by CIRCUTOR) or without the filter.
THD Algorithm [RMS or fundamental]	This lets the user select the form of calculation for the rate of total harmonic distortion. The options are RMS and Fundamental (see NOTE)

NOTE: Forms of calculating THD for a magnitude X

- Fundamental $d(X)\% = 100 * \frac{\sqrt{\sum_2^{40}(X_i)^2}}{X_1}$ Distortion refers to the fundamental component (the IEC Standard sometimes calls it *d(X)%,* but the IEEE Standard still calls it *THD(X)%*
- RMS $THD(X)\% = 100 * \frac{\sqrt{\sum_2^{40}(X_i)^2}}{\sqrt{\sum_1^{40}(X_i)^2}}$ Distortion refers to the total RMS value

10.2.3 Variable selection

On this screen the unit allows the selection of the variables the user wish to log



Screen sections:

- Basic options
- Basic parameters
- Quality
- Harmonics
- Wave shapes

Fig. 10-6.- Variables selection screen

The unit will log the variables that the user selects on this screen. The options are grouped under the following headings:

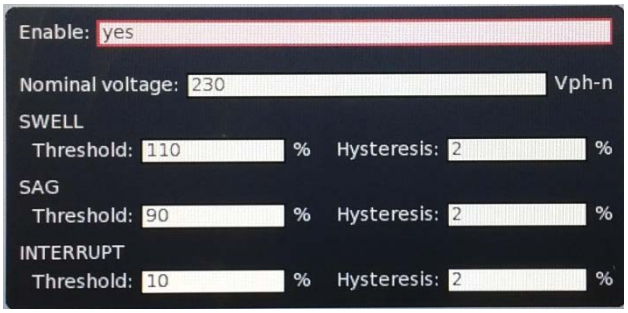
Basic options: These options generally affect the overall measurement. For example, the option to log consumption (2 quadrants) or consumption and generation (4 quadrants). It also lets the user select whether it must log instantaneous values, maximum and minimum values, average three-phase values, etc.

Basic parameters: This lets the user select the individual variables. Users can select the specific variables they wish to log, such as voltages, currents, quality parameters, wave shapes and number of harmonics.

Use the ◄/ ► buttons to move between basic options, basic parameters, quality, harmonics, wave shapes; use the ▼/ ▲ buttons to move between the variable fields to be selected. Use the λbutton to activate or deactivate the variable or group of variables.

10.2.4 Events setup (EVQ setup)

This menu lets the user configure the events logged by the AR6.



Configurable Parameters:

- Enable
- Rated voltage
- Peak threshold
- Peak hysteresis
- Sag threshold
- Sag hysteresis
- Outage threshold
- Outage hysteresis

Fig.10-7.- Events configuration

Fig.10-8 shows some examples of events that are described below.

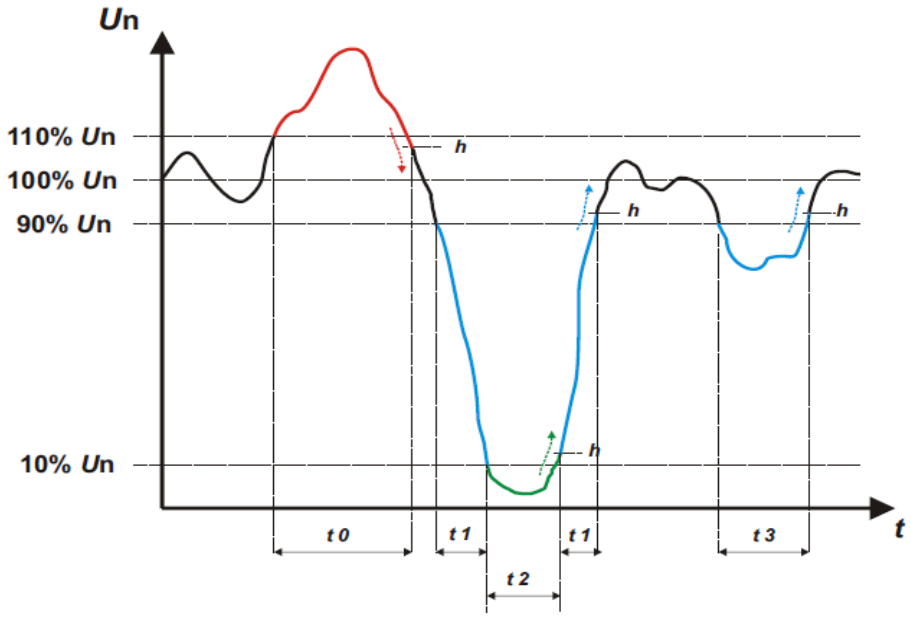


Fig.10-8.- Examples of events

Fig.10-8 shows an example of a swell event, bound by time interval t0. The duration of the event is equal to the time that the signal was above the configured threshold value (equal to 110 % of Vnom) plus the time that the signal takes to decrease its value, including the programmed hysteresis, usually 2%.

Other events visible in Fig.10-8 are those bounded by intervals t1, t2 and t3. These events are two sags (t1 and t3) and one interruption (t2). According to the IEC Standard, a sag means that the voltage is between 90% and 10% of V_{nom} and an interruption means that the voltage drops below 10% in the three phases. (in this case an outage is logged in interval t2, the duration of which includes the hysteresis,

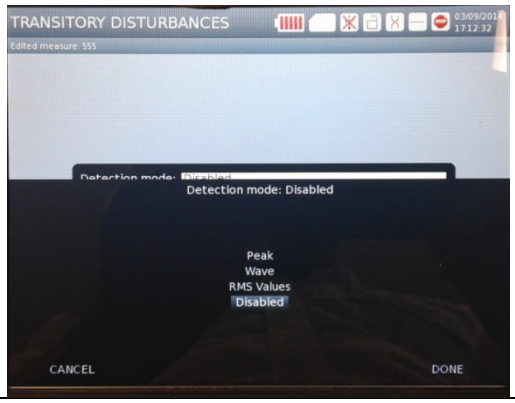
Quality events logged by the AR6 must last a minimum of 10 ms. If the event does not last this long it is not logged as such, although it does affect the calculated average value of that period.

	The quality events log is automatically disabled for 10 minutes when it detects more than 1 event/second for 15 seconds. This deactivation process is repeated 5 times, after which the log is permanently disabled to prevent a bad EVQ configuration from filling up the analyzer's internal memory.

10.2.5 Transients

The detection of transients lets the user detect different types of voltage wave defects. When the user clicks on the transients menu option the screen in Fig. 10-11 or similar will appear.

Clicking the**" Detection mode"** window allows the selection among the following options:



Configurable options for detection method:

- ***Peak***
- ***Wave***
- ***RMS Value***
- ***Disabled***

Fig. 10-9.- Configurable options for capturing transients

PEAK

The detection of transients based on the peak value occurs when the absolute value of one or several voltage samples exceed a certain threshold value set in this screen. The setting should be large enough to avoid it from being tripped with normal amplitudes or even those slightly above 110% of the nominal peak value.

The detection is based on phase-neutral voltage value. If there is no neutral, the set value should be the maximum phase-phase voltage value divided by$\sqrt{3}$

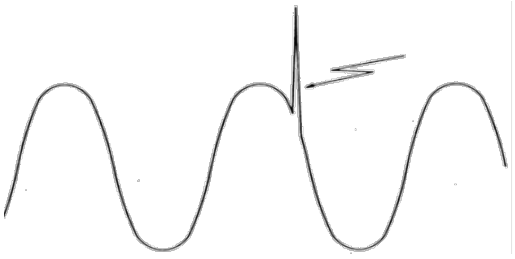
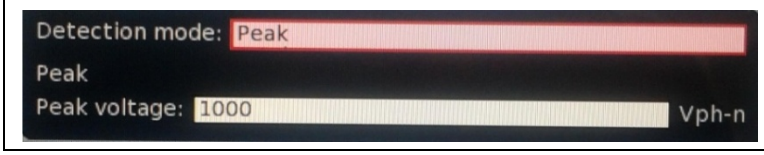


Fig. 10-10.- Peak value defect



Configurable Parameters:

- Peak voltage in V phase to neutral

Fig. 10-11.- Configuration for transient detection based on Peak value

WAVE

The detection of transients using the “wave” option occurs when there is a defect in the wave shape so that the it exceeds the limits of a square defined by a threshold value (V phase to neutral) and a duration (indicated in % of the period)

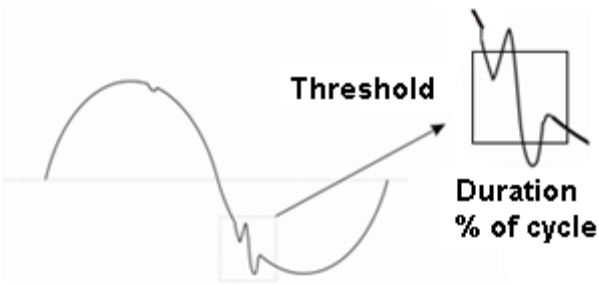


Fig.10-12.- Wave shape defect

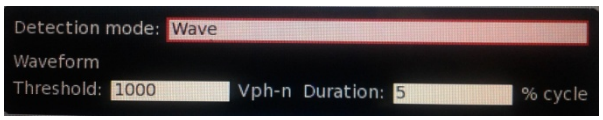


Fig. 10-13.- Wave shape defect configuration screen

Configurable Parameters:

- Threshold in V , phase to neutral
- Duration in % of the cycle

RMS Values

The detection of transients based on RMS values is achieved by comparing the value of each cycle of each channel with the RMS value of the previous cycle of the same channel. If the difference between RMS values exceeds that configured by the user, the current cycle is logged as a defect. The user can program a difference of between 30 and 800 V_{RMS}.

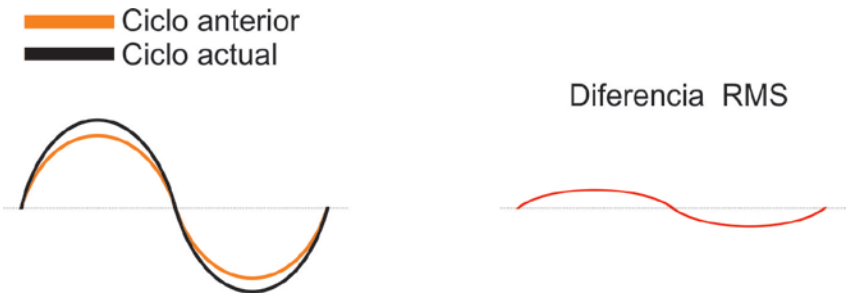


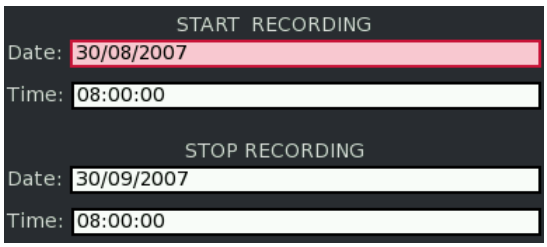
Fig.10-14.- Difference in RMS value defect

Disabled: This option lets the user disable the detection of transients

The transients log is automatically disabled for 10 minutes when it detects more than 1 transient/second in 15 seconds. This deactivation process is repeated 5 times, after which the log is permanently disabled to prevent a bad transient detection configuration from filling up the analyzer's internal memory.

10.2.6 Trigger interval

The trigger interval menu lets the user configure the start and end dates and times to activate the data logging.



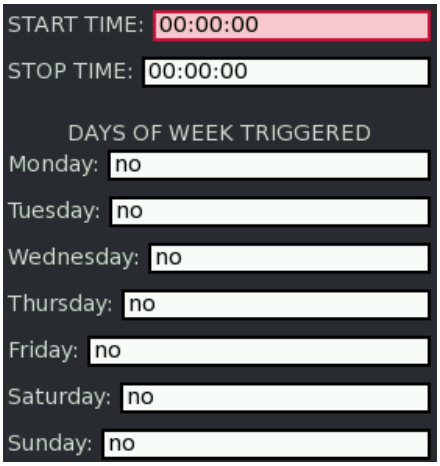
Configurable Parameters:

- Date and time to start recording
- Date and time to end recording.

Fig.10-15.- Log interval configuration screen

10.2.7 Periodic trigger

The periodic trigger menu lets the user configure the start and end times and the days of the week to activate the data logging.



Configurable Parameters:

- Recording start time
- Recording end time.
- Day of the week the previous recording condition must be applied.

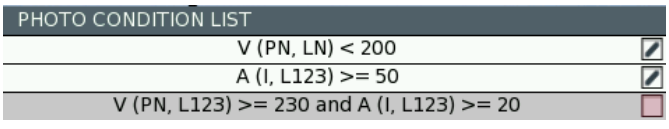
Fig.10-16.- Periodic log configuration screen

After configuring a log interval or a periodic log the user must activate this configuration using the (Enable / Disable) option in the ACTIONS menu. Once the desired logging condition has been enabled, the user must click the λ (REC/STOP) button

The unit waits for the condition to be met to start logging. This is indicated in the messages area (Fig.5-2) with the icon.

10.2.8 Photo trigger conditions using measured data

A “Photo” or "snapshot" is an instantaneous log of all the variables measured by the analyzer, including wave shapes. The PHOTO CONDITIONS menu lets the user configure the logical equations to trip (trigger) a snapshot (capture of data), using the measured data as trigger variables. With the create or modify option on the dynamic menu the user can easily and intuitively create or edit the trip formulas by following the menus



Viewed parameters:

The screen displays the list of “photo” conditions created. The active conditions are indicated with the activated check mark.

Fig.10-17.- Screen showing a trip condition for a snapshot

Upon selecting the create new or edit existing condition option, the following screen is displayed, in which the user may create the trip conditions needed and may combine them with other trip operations using the logical functions AND and OR.

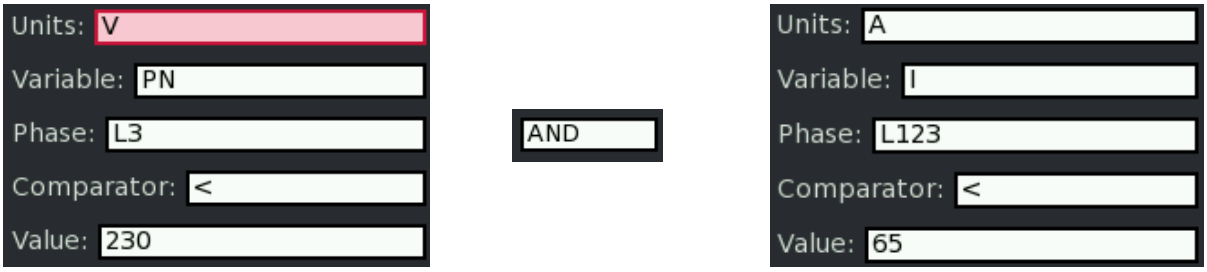


Fig.10-18.- Creation of “photo” trigger conditions

	The AR6 has a limit of 10 different snapshot conditions. After it reaches this limit it does not allow the user to create any more conditions.

	To prepare the analyzer to start the data logging in accordance with the programming of log intervals, periodic logs or transients, click the λ (REC/STOP) log button after programming the desired start-up and stop conditions.

10.2.9 Recording trigger conditions

The network analyzer allows the use of formulae similar to those used for “photo” recordings to create the trigger conditions for data logging start/stop.

This lets the user program the log recording parameters when certain conditions are met, otherwise the log will stop.

10.3 CLEAR

Delete the selected measurement files keeping their configuration. This is the recommended procedure to delete recorded data which are no longer necessary in the analyzer.

10.4 CLEAR ALL

Delete the data for all the measurements the unit has saved, keeping their configuration. This is the recommended procedure to delete data stored on the analyzer's memory.

10.5 REMOVE

Permanently remove the selected measurement. This option erases the recorded data and also the configuration.

10.6 ACTIVATE

Change the measurement selected for active logging. It performs the same function as the confirmation button ● on a measurement at the cursor location.

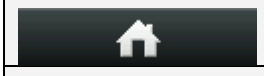
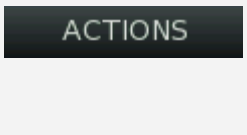
11 MEASUREMENT ANALYSIS MENU

This main menu option lets the user display logs, snapshots or disturbances logged for each measurement file. To start this menu, select the icon in the figure to the left and click the confirmation button ●

Fig. 11-1.- List of measurements

The screen displays a list of the various measurements created on the unit. Only one of these measurements will be active.
Use the grey cursor to move to the measurement to be analysed. The log must be stopped to analyse a measurement. Once the measurement has been selected, drop down the ACTIONS menu to select.

The options for the dynamic ACTIONS button (bottom part of the screen) are:

Key	Function	Description
	Home	Brings up the main menu
		• Records: Displays the STD registered parameters • Photos: Displays the Photo registered in the measure selected. • Disturbances: Displays the disturbances detected in the measure selected. • UNIPEDE table: Allows grouping the registered quality events in a table.

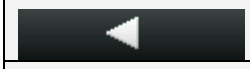
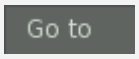
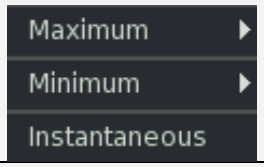
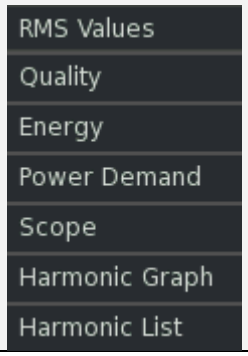
11.1 RECORDS

Logs are shown on the same display screens as instantaneous parameters. The difference is that the date and time of the displayed log is shown at the top of the screen.

RMS VALUES
15/09/2014
14:32:03
Analyzed measure: maquina1 (rec.std)
Register: 1/501 - 04/07/2014 - 10:22:00
Instantaneous Voltage and Current
L1 L2 L3 LIII LK
Vpn na na na na
Vpp 395.2 395.3 396.1 395.5
A 10.19 9.29 9.48 9.65 0
Instantaneous Power
L1 L2 L3 LIII
kW 1.19 1.01 1.24 3.45
kvarL 1.98 1.83 1.75 5.57
kvarC 0 0 0 0
kVA 2.33 2.12 2.17 6.61
PF 0.51 0.48 0.57 0.52
cosphi 0.51 0.48 0.58 0.53
Instantaneous frequency
Hz 50.01

Fig.11-2.- Records

The options for the dynamic menus of this screen (bottom part of the screen) are:

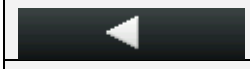
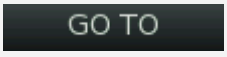
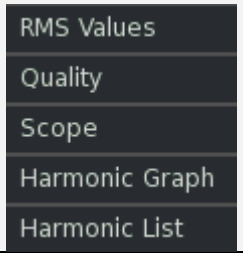
Key	Function	Description
	BACK	Brings up the previous screen.
		Allows selection of a date and time to view the recorded parameters on the screen.
		Allows the display to be switched between instantaneous, maximum and minimum values and between consumed and generated values.
		Allows selection between different display options shown in the menu. RMS Values, Quality, Energy, Maximum Demand, waveform, graph and list of harmonics.

Within each option it allows selection of the "Go to" option to select the desired display date and time.

11.2 PHOTOS

The information logged in “PHOTOS” is displayed in the RMS value display tables. The tables show the instantaneous values of each variable taken at the time of the snapshot.

The options for the dynamic keys (menu at the bottom of screen) are as follows:

Key	Function	Description
	BACK	Brings up the previous screen.
		Allows selection of a date and time to view the recorded parameters on the screen.
		Allows selection between different display options shown in the menu. RMS Values, Quality, waveform, graph and list of harmonics.

11.3 DISTURBANCES

Disturbances recorded by the analyzer appear on a table, in which a short information about each one is displayed. The information is preceded by an acknowledgement icon for each disturbance type and its numerical information as an average voltage value, previous value, final value and duration.

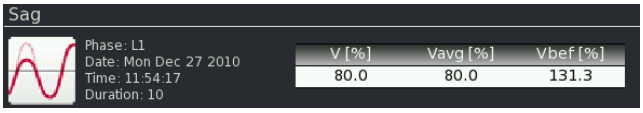


Fig. 11-3.- Example of the disturbance type icon

Parameters displayed:

- Different disturbance types detected (the example shows a table with several types of records)
- The phase affected by the disturbance
- The date and time when the disturbance occurred.
- The disturbance duration in milliseconds.

Disturbances

Network	Phase	Date	Time	ms
Sag	L1	27.12.2010	11:54:17.043	10
Interrupt	L1	27.12.2010	11:54:18.095	1520
Sag	L1	27.12.2010	11:54:18.095	10
Transient		27.12.2010	11:54:22	
Transient		27.12.2010	11:54:30	
Sag	L1	27.12.2010	11:54:34.032	10
Transient		27.12.2010	11:54:37	

Fig. 11-4.- Example of a disturbance table. In this case the selected one is a sag

The disturbances screen lets the user see several types of disturbances. Each one is identified with an specific icon. Fig.11-5shows the icons identifying different types of disturbances.

NOTE: The configuration of what is considered to be a disturbance corresponds with the configuration made by the user for the PHOTO and EVQ events logging configuration page.

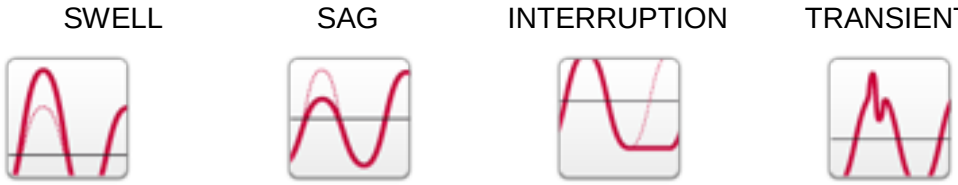


Fig.11-5.- Various types of disturbances that can be logged

The user can move through the various disturbances displayed in the table by using the ▼/ ▲ navigation buttons. Once the cursor is located over a specific disturbance, it is possible to see the captured wave shape by clicking the confirmation button λ

11.3.1 Disturbance wave shape

This is a graphic screen showing the wave shape of the event selected from the table. On this screen, as with the rest of the graphic screens, it is possible to zoom different areas. The dynamic key ACTIONS , opens a menu to Zoom IN or OUT any zone of the graph.

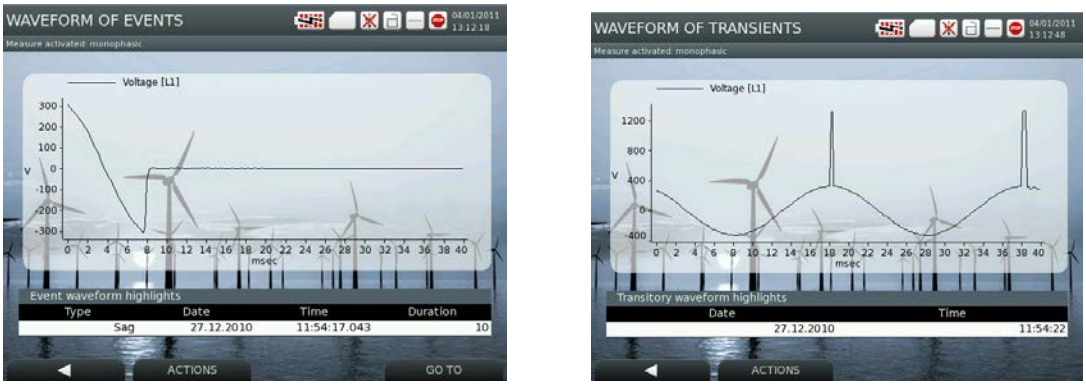
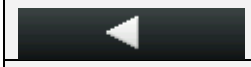
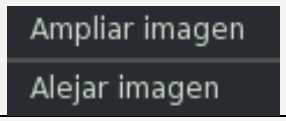
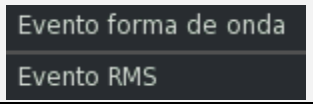


Fig.11-6.- Examples of wave shape screens

The dynamic keys in the waveform screens offer the following functions:

Button	Function	Description
	BACK	Brings up the previous screen.
		The selected part of the signal can be magnified using the ZOOM IN option. The ZOOM OUT option cancels the magnification of the image displayed.
		Allows the selected transients display to be switched between wave shape and RMS graphic and vice versa.

11.3.2 RMS value of a transient or event

This menu option allows the display, in graphic form, of RMS values of a selected event or transient

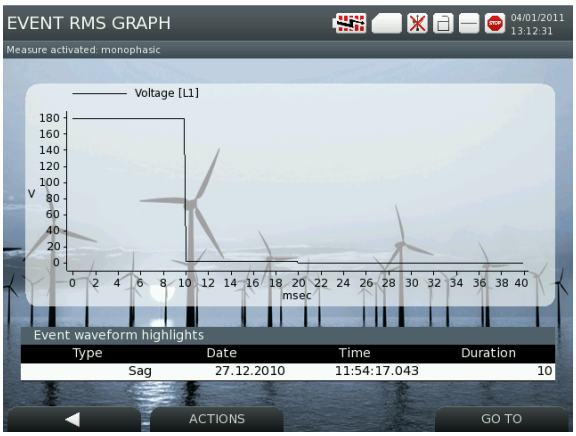


Fig.11-7.- RMS value of a transient or event

11.4 UNIPEDE TABLE

The AR6 can view what is known as a UNIPEDE table on its screen. This table is a summary of the quality events logged by the unit, grouped in accordance with their amplitude and duration; an example is shown in Fig.11-8.

Disturbances per magnitude and duration - L123						
	10≤t<100 [ms]	100≤t<500 [ms]	0.5≤t<1 [s]	1≤t<3 [s]	3≤t<20 [s]	20≤t<60 [s]
Swell	0	0	0	0	0	0
10≤V<15 [%]	0	0	0	0	0	0
15≤V<30 [%]	0	0	0	0	0	0
30≤V<60 [%]	5	0	6	0	0	0
60≤V<99 [%]	14	6	0	0	0	0
Interrupt	0	0	0	0	6	0

Fig.11-8.- Example of a UNIPEDE Table

In this table, it is possible to view the events of each phase independently or group them into a single average value for the three phases (what we will call the three-phase value). The analyzer performs the time grouping following the criteria of the EN 50160 quality standard, which are summarised below.

11.4.1 Events grouping in accordance with UNIPEDE criteria

- In three-phase systems a swell starts when the value U_{RMS} of the voltage of one or more phases exceeds the set-point for detecting an over-voltage (usually 110% of rated value); it ends when the value U_{RMS} for all the phases is less than or equal to the set-point minus the configured hysteresis value (t0)

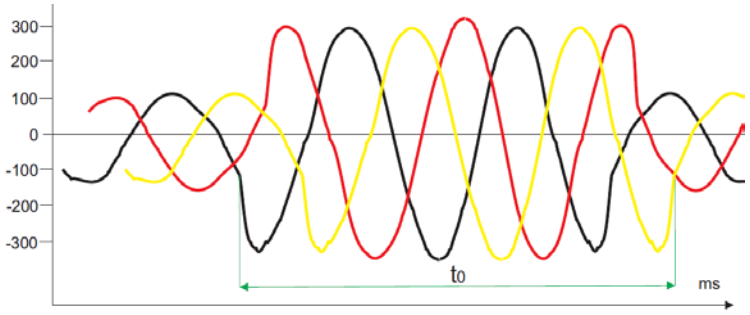


Fig.11-9.- Start and end of a swell in a three-phase system

- In three-phase systems a sag starts when the value U_{RMS} of the voltage of one or more phases is below the threshold for detecting sags (usually 90% of rated value); it ends when the U_{RMS} is greater than or equal to the threshold plus the configured hysteresis value (t1) or if all phases are below the interruption level (usually 10% of rated value).

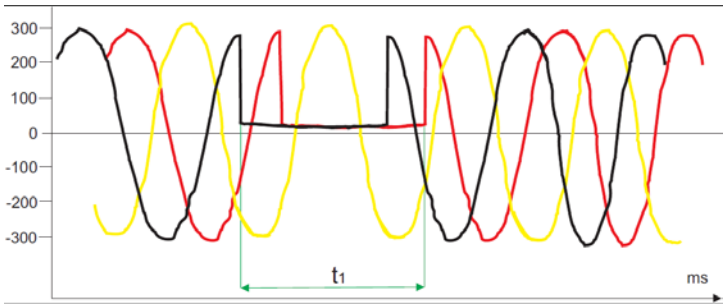


Fig.11-10.- Start and end of a sag in a three-phase system

- In three-phase systems an interruption starts when the value U_{RMS} of the voltage of all the phases is below the threshold for detecting interruptions (usually 10% of rated value); it ends when the value URMS of any phase is greater than or equal to the threshold plus the configured hysteresis value (t2).

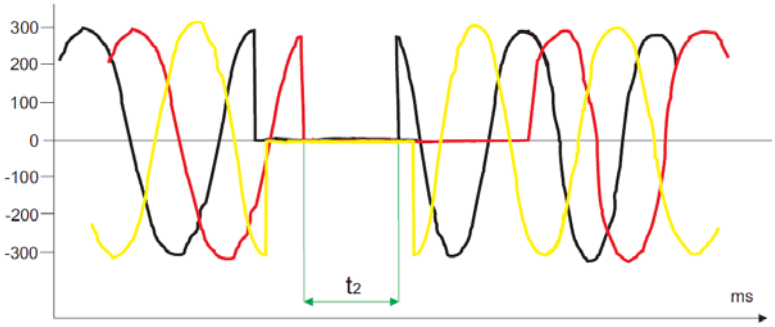
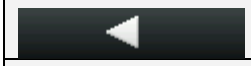
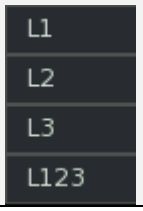


Fig.11-11.- Start and end of an interruption in a three-phase system

In the values shown for the individual phases, the time shown refers to each event; no grouping is done.

The available dynamic menu options for the UNIPEDE table screen are:

Button	Function	Description
	BACK	Brings up the previous screen.
		Updates the data in the table after reactivating the log without changing the active measurement.
		Allows changing the display of the values in the table among the individual events of each phase or the events grouped in three-phase

12 WAVEFORM MENU

The WAVEFORM screen shows the temporary graphics for one or several voltages, for one or several currents or for voltages and currents at the same time. The user can select the desired phase: L1, L2, L3, LIII or LN

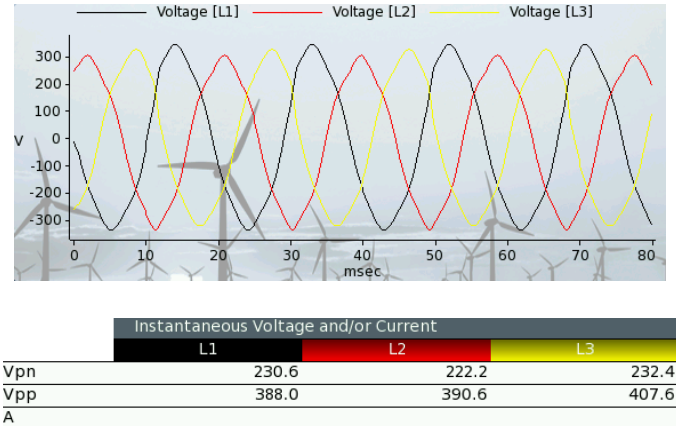
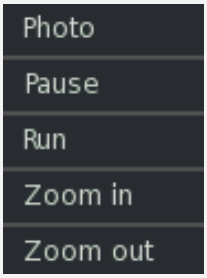


Fig.12-1.- Wave shapes screen

The dynamic menu options for the "wave shapes" screen are:

Button	Function	Description
	Main Menu	Brings up the main menu
		Snapshot, captures all the instantaneous values measured by the analyzer along with the voltage and current wave shapes. Pause, stops screen refreshing, Run, restarts screen refreshing, showing the values in real time. Zoom in and Zoom out operate the zoom to increase and reduce the image size

VIEW	Voltage Current Voltage Current L1 L2 L3 L123 LN LK	Allows selection among L1, L2, L3, L123 or LN phases in order to display the wave shapes individually.

12.1 PHOTO

The Photo option captures all the instantaneous values measured by the analyzer along with the voltage and current wave shapes.

12.2 PAUSE

The "Pause" option stops screen refreshing and keeps the values of the variables on the screen

12.3 RUN

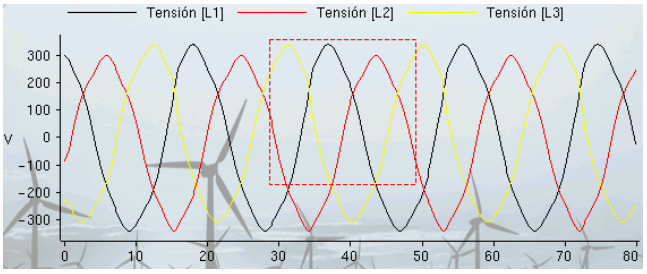
The "Run" option restarts screen refreshing, showing the values in real time.

12.4 ZOOM IN, ZOOM OUT

The analyzer allows magnification of the image on the wave shapes screen. In order to do this, the image must be paused. Use the ▼/ ▲ buttons to move the cursor to the "Pause" option of the ACTIONS menu.

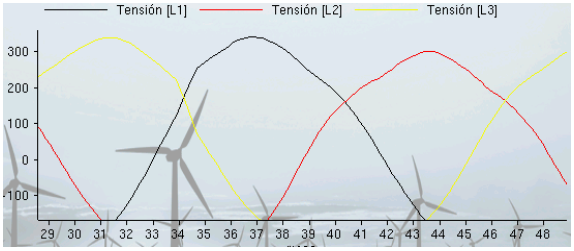
Then select Zoom Image, and a white box with a dashed border appears on the graphics screen. This is the zoom area.

Use the ◄/ ► and ▼/ ▲ buttons to move the box to the desired area. The λ button confirms the position of the box and changes the colour to red.



Once the position is locked, the size of the selection box may be changed using the ◄/ ► and ▼/ ▲ buttons. Once the area is selected, click λ to zoom.

Fig. 12-2.- Selection of the zoom area



Once pressed, the selected area is magnified.

Use the ◄/ ► and ▼/ ▲ buttons to select Zoom Out and press λ to undo the zoom

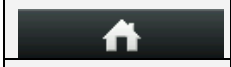
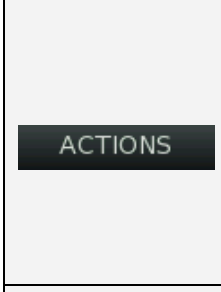
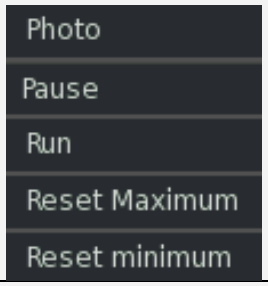
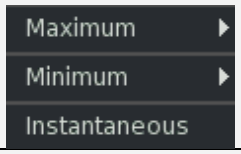
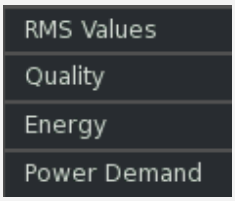
Fig. 12-3.- Zoom area expanded

13 METER MENU

The METER menu allows to measure and record data. Data are presented in different screens in table format. The available screens are:

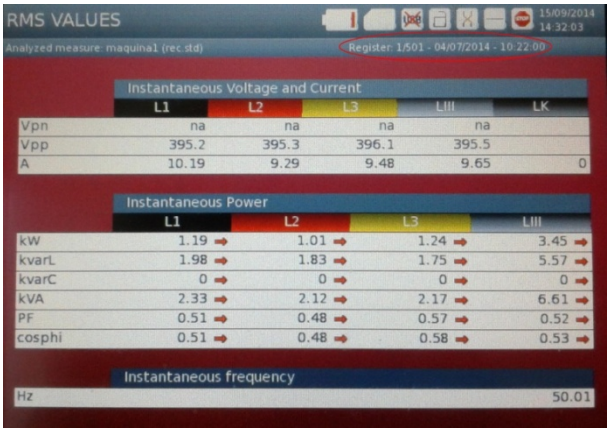
- RMS values screen.
- Power quality screen.
- Energy screen.
- Power demand screen.

The dynamic menu options on this screen are as shown below. The different screens are selected from the dynamic GO TO menu.

Button	Function	Description
	Main Menu	Brings up the main menu
		Allows starting and stopping data recording (Pause / Run). The Photo option allows the capture of all instantaneous values measured by the analyzer along with the waveforms of voltages and currents. This PHOTO data are recorded in the SD card, in a file with extension .PHO and the name of the active measure. With the Reset options, the user can erase the maximum and minimum values stored.
		Allows the display to be switched between instantaneous, maximum and minimum values. It also gives consumed and generated values.
		The user can choose to display the measured and calculated electrical parameters (RMS) or power quality parameters of network or energy or power demand.

13.1 REAL TIME RMS VALUES SCREEN

The instantaneous values screen appears by default when the user enters the METER menu. It displays the RMS values of the basic electrical parameters.


RMS VALUES
15/09/2014
14:32:03
Analyzed measure: maquina1 (rec.std)
Register: 1/501 - 04/07/2014 - 10:22:00
Instantaneous Voltage and Current
L1 L2 L3 LIII LK
Vpn na na na na
Vpp 395.2 395.3 396.1 395.5
A 10.19 9.29 9.48 9.65 0
Instantaneous Power
L1 L2 L3 LIII
kW 1.19 1.01 1.24 3.45
kvarL 1.98 1.83 1.75 5.57
kvarC 0 0 0 0
kVA 2.33 2.12 2.17 6.61
PF 0.51 0.48 0.57 0.52
cosphi 0.51 0.48 0.58 0.53
Instantaneous frequency
Hz 50.01

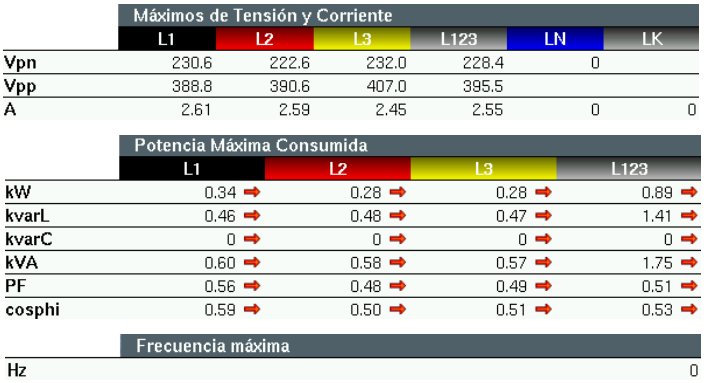
Displayed parameters:

- Phase-neutral voltage, Vpn
- Phase-phase voltage, Vpp
- Current, A
- Active power, kW
- Reactive power, kvarL
- Reactive power, kvarC
- Apparent power, kVA
- Power factor, PF
- cosphi is cosφ
- Frequency

Fig.13-1.- Example of an RMS instantaneous values screen

13.1.1 VIEW maximum or minimum values option (consumed or generated)

There are three basic display models that are selected in the dynamic VIEW menu: Instantaneous, Maximum and Minimum. If either the Maximum or Minimum option is selected in the VIEW menu, the screen in Fig.13-2 will appear. In the Powers section, the user can see Maximum or Minimum values of generated or consumed power. Use the ▼/ ▲ buttons to toggle between the value, the date and the time at which the maximum or minimum values occurred. Power consumed is indicated with a red arrow → and power generated by a green arrow ←.



Máximos de Tensión y Corriente						
	L1	L2	L3	L123	LN	LK
Vpn	230.6	222.6	232.0	228.4	0	
Vpp	388.8	390.6	407.0	395.5		
A	2.61	2.59	2.45	2.55	0	0

Potencia Máxima Consumida				
	L1	L2	L3	L123
kW	0.34 →	0.28 →	0.28 →	0.89 →
kvarL	0.46 →	0.48 →	0.47 →	1.41 →
kvarC	0 →	0 →	0 →	0 →
kVA	0.60 →	0.58 →	0.57 →	1.75 →
PF	0.56 →	0.48 →	0.49 →	0.51 →
cosphi	0.59 →	0.50 →	0.51 →	0.53 →

Frecuencia máxima	
Hz	0

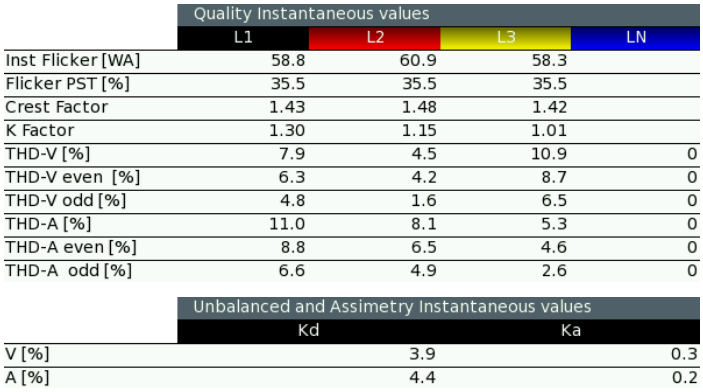
Viewed parameters:

- Phase-neutral voltage, Vpn
- Phase-phase voltage, Vpp
- Current, A
- Active power, kW
- Reactive power, kvarL
- Reactive power, kvarC
- Apparent power, kVA
- Power factor, PF
- Cos phi angle φ
- Frequency

Fig.13-2.- Example of a maximum values consumed screen

13.2 POWER QUALITY SCREEN

On this screen the parameters most relevant to the quality of the measured network are displayed



Quality Instantaneous values				
	L1	L2	L3	LN
Inst Flicker [WA]	58.8	60.9	58.3	
Flicker PST [%]	35.5	35.5	35.5	
Crest Factor	1.43	1.48	1.42	
K Factor	1.30	1.15	1.01	
THD-V [%]	7.9	4.5	10.9	0
THD-V even [%]	6.3	4.2	8.7	0
THD-V odd [%]	4.8	1.6	6.5	0
THD-A [%]	11.0	8.1	5.3	0
THD-A even [%]	8.8	6.5	4.6	0
THD-A odd [%]	6.6	4.9	2.6	0

Unbalanced and Assimetry Instantaneous values		
	Kd	Ka
V [%]	3.9	0.3
A [%]	4.4	0.2

Displayed parameters:

- Instantaneous flicker (WA)
- PST Flicker
- Crest factor
- K-Factor
- THD V, THD V odd, THD V even
- THD A, THD A odd, THD A even
- Imbalance V, A
- Asymmetry V, A

Fig.13-3.- Example of instantaneous power quality display

The dynamic menu options for this screen are the same as those indicated in the beginning of section 0.

13.2.1 VIEW quality maximum or minimum values option

Displays the maximum or minimum values (according to selection) of the quality parameters. Use the ▼/ ▲ buttons to toggle between these values. For each case, the date and the time at which the maximum or minimum values occurred is displayed.

The dynamic menu options for this screen are the same as those indicated in the beginning of section 0.

13.3 ACCUMULATED ENERGY SCREEN

This screen shows the accumulated values of consumed and generated energy from the last reset of the energy meters.

	TOTAL ENERGY	
	CONSUMED	GENERATED
kWh	6.28	0
kvarCh	0.46	0
kvarLh	9.88	0
kVAh	10.47	0

Fig. 13-4.- Example of accumulated energies screen

Viewed parameters:

- Active energy, kWh
- Capacitive reactive energy, KvarCh,
- Inductive reactive energy, KvarLh,
- Apparent energy, kvah,

Energies consumed and generated are shown separately for all of them

The dynamic menu options for this screen are the same as those indicated in the beginning of section 0.

13.4 MAXIMUM DEMAND SCREEN

This screen measures the maximum or instantaneous energy demand values.

	Instantaneous values of Power Demand			
	L1	L2	L3	L123
kW				0
kVA				0
A	0	0	0	0

Fig. 13-5.- Example of a maximum demand screen (instantaneous value)

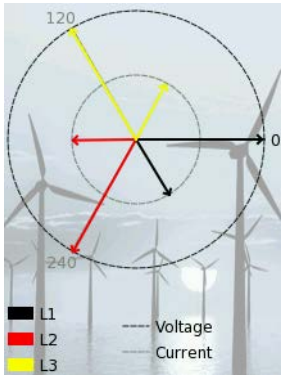
Displayed parameters:

- Total active power [kW] of LIII
- Total apparent power [kVA] of LIII
- Total current by phase [A] of LIII, L1, L2, L3.

The dynamic menu options for this screen are the same as those indicated in the beginning of section 0 , except for the VIEW menu, which only has the instantaneous and maximum options.

14 PHASORS MENU

The screen shows the phasors representation of the voltages and currents of each phase and the phase angle of each of them with respect to the voltage in L1.



	ANGLE AND MODULES		
	L1	L2	L3
V angle	0	-119.4	-239.3
V mod	154.2	156.0	155.6
A angle	-58.8	-179.2	-298.4
A mod	1.75	1.73	1.71

	ANGLE BETWEEN PHASES		
	L2-L1	L3-L2	L1-L3
V	116.7	121.2	121.9
A	121.7	116.5	121.6

	VOLTAGE / CURRENT DISPHASE		
	L1	L2	L3
V-A	57.5	62.5	57.7

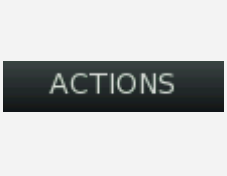
PHASE SEQUENCE
L1-L2-L3

Displayed Parameters:

- Phasors of *V* and *I*
- Modules of *V* and *I* and phase angles referred to V1
- Angles between phases (L1-L2, L2-L3 and L1-L3) for *V* and *I*
- Phase shift between *V* and *I* of different phases.
- Phase sequence.

Fig.14-1.-Phasors screen

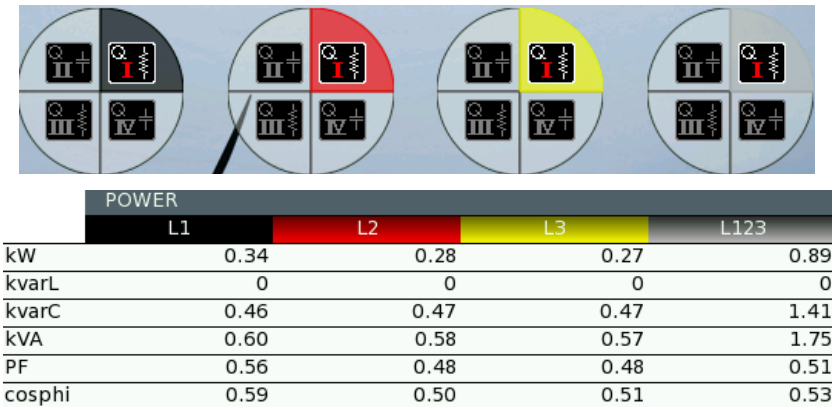
The dynamic menu options for this screen are:

Button	Function	Description
	Main Menu	Brings up the main menu
	Photo Pause Run	The Photo option captures all the instantaneous values along with the voltage and current wave shapes of the three phases. The "Pause" option stops screen refreshing and the "Run" option restarts screen refreshing, showing the values in real time.
	L1 L2 L3 L123	Allows selection among L1, L2, L3 in order to display them individually or L123 to display them simultaneously

15 QUADRANTS MENU

This screen shows the power values of each phase and the three-phase system as a whole, indicating the quadrant for each one. The powers indicated are:

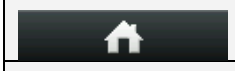
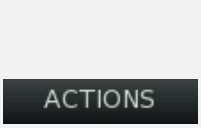
- Active power *kW*
- Inductive reactive power *kvarL*
- Capacitive reactive power *kvarC*
- Power factor
- cosphi (*Cos* ϕ)



	POWER			
	L1	L2	L3	L123
kW	0.34	0.28	0.27	0.89
kvarL	0	0	0	0
kvarC	0.46	0.47	0.47	1.41
kVA	0.60	0.58	0.57	1.75
PF	0.56	0.48	0.48	0.51
cosphi	0.59	0.50	0.51	0.53

Fig.15-1.- Main screen of the quadrants menu

The dynamic menu options for this screen are:

Button	Function	Description
	Main Menu	Brings up the main menu
	Photo Pause Run	The Photo option captures all the instantaneous values along with the voltage and current wave shapes of the three phases. The "Pause" option stops screen refreshing and the "Run" option restarts screen refreshing, showing the values in real time.

16 HARMONICS MENU

This screen displays the harmonics content of voltages and currents measured by the instrument. This data can be presented in a bar graph (Fig. 16-1) or in table format

Move through the spectrum using the ◄/► buttons to select the various harmonics. Selecting a harmonic changes it to dark grey and its values are displayed in the table at the bottom of the screen; see Fig. 16-1 and Fig.16-2.

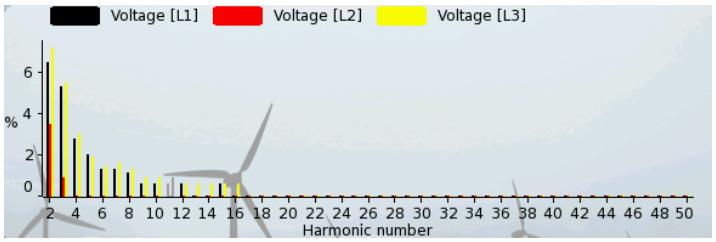


Fig. 16-1.- Graphic representation of harmonics (as an example, voltage harmonics in the three phases)

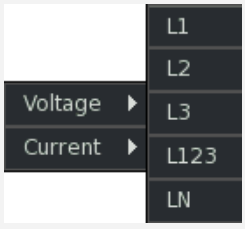
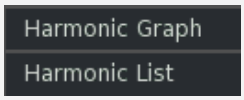
Parameters displayed:

- Harmonic distortion.
- THD according to selection
- THD of even harmonics
- THD of odd harmonics
- Fundamental
- Fundamental %.

	VOLTAGE SELECTED HARMONIC		
	L1	L2	L3
THD-V [%]	9.4	3.6	10.3
THD-V even [%]	7.3	3.5	8.1
THD-V odd [%]	5.9	0.9	6.3
Fundamental	154.9	156.2	155.2
Harmonic selected [%]: 11	0.6	0	0.9

Fig.16-2.- Table at the bottom. Shows general data of harmonics and data for a selected harmonic in the bar graph(in the example, 11th order harmonic)

The dynamic menu options at the bottom of the screen for the "harmonics" menu are:

Button	Function	Description
	Main Menu	Brings up the main menu
		The Photo option captures all the instantaneous values along with the voltage and current wave shapes of the three phases. The "Pause" option stops screen refreshing and the "Run" option restarts screen refreshing, showing the values in real time.
		Lets the user select the voltages and currents displayed independently and select the phase or phases to display (or neutral for current)
		Lets the user select the harmonics to be displayed, up to n=50 ,in graphic or in table format (list).

When user enters in the Harmonics menu (graph or table) the screen shows harmonics in real time. The user can use the "Pause" / “Run” options on the ACTIONS menu to stop refreshing the screen, or to go back to the real time representation.

Fig.16-3 and Fig.16-4 show an example of the representation in table format.

	L1	L2	L3
Harmonic 2	51.0	85.0	52.0
Harmonic 3	14.0	47.0	14.0
Harmonic 4	15.0	27.0	20.0
Harmonic 5	0	18.0	15.0
Harmonic 6	6.0	22.0	12.0
Harmonic 7	6.0	16.0	8.0
Harmonic 8	0	15.0	8.0
Harmonic 9	0	11.0	6.0

Fig.16-3.- Harmonics representation in table format (as an example, voltage in the three phases)

	VOLTAGE SELECTED HARMONIC		
	L1	L2	L3
THD-V [%]	4.7	10.7	6.8
THD-V even [%]	4.3	9.0	6.4
THD-V odd [%]	1.9	5.7	2.1
Fundamental	160.4	147.5	159.8
Harmonic selected [%]	6.0	16.0	12.0

Fig.16-4.- Table at the bottom. Shows general harmonics data and data for the selected harmonic (in the example, second order harmonic)

The dynamic menu for this screen has the same options as the harmonic graphic screen.

17 CONNECTION DIAGRAMS

	For measurements requiring connection of the earthing cable, the corresponding option in the active measurement menu must be correctly configured

17.1 THREE-PHASE CONNECTION WITH NEUTRAL

If the proper clamps are used, this allows measurement of the voltage and current of the three phases and neutral, voltage between neutral and earth and leakage current.

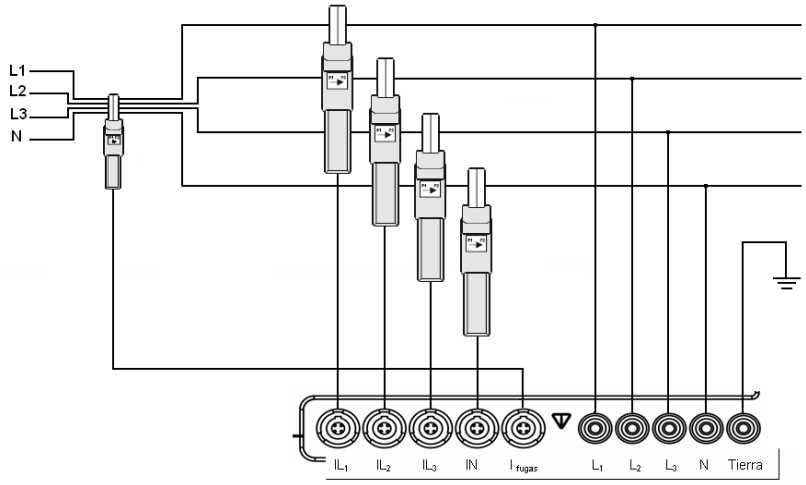


Fig.17-1.- Connection for measurement of a three-phase system with neutral and earth

17.2 THREE-PHASE CONNECTION WITH NEUTRAL

Measurement of the voltage and current of the three phases and leakage current.

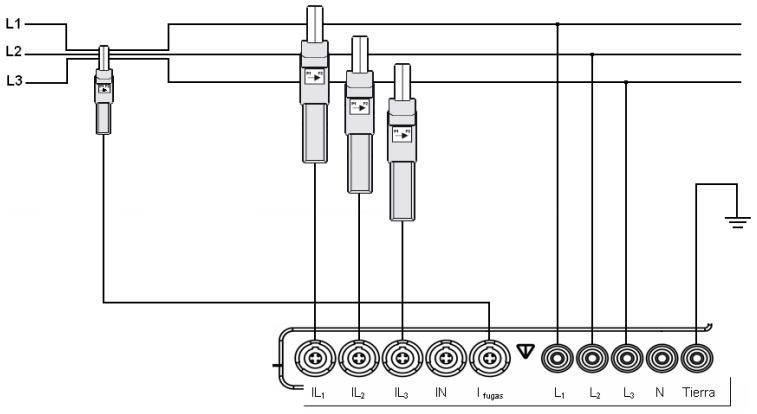


Fig.17-2.- Connection for measurement of a three-phase system without neutral and with earth

17.3 THREE-PHASE ARON CONNECTION

Measurement of the voltage of the three phases.Measurement of the phase current L1-L3 and calculation of current in L2.Measurement of leakage current.

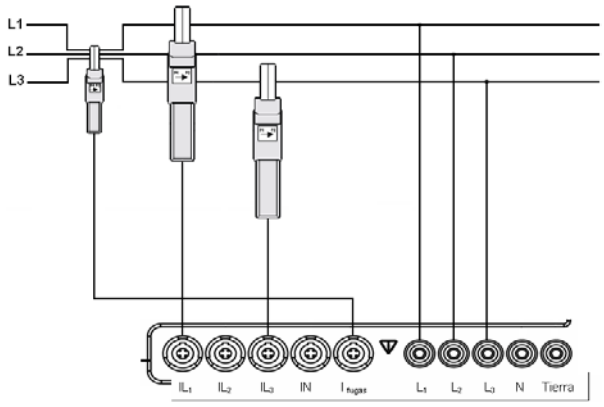


Fig.17-3.- Connection for measurement of a three-phase system, without neutral, using the Aron method

17.4 TWO-PHASE CONNECTION

Measurement of the voltage between two phases, current of the two phases and leakage current.

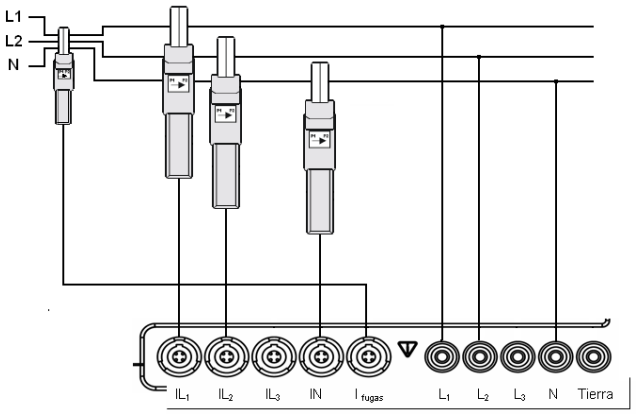


Fig.17-4.- Connection for measurement of a system with two phases + neutral

17.5 SINGLE-PHASE CONNECTION

Measurement of the voltage and current between phase and neutral, voltage between neutral and earth and leakage current.

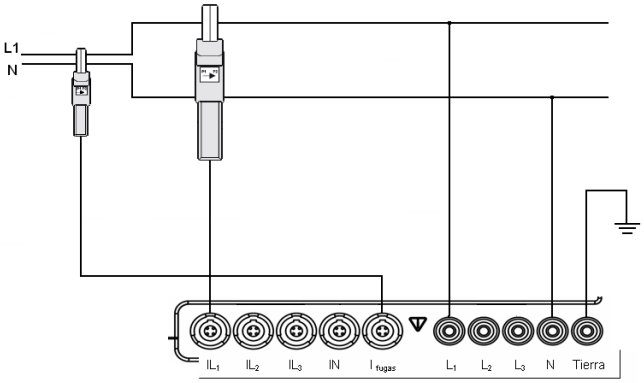


Fig.17-5.- Connection for measuring a single-phase system with earth

17.6 MEASURED / CALCULATED ELECTRICAL PARAMETERS IN ACCORDANCE WITH THE CONNECTION TYPE

THREE-PHASE CONNECTION 4 WIRES								
Display Variables	**L1**	**L2**	**L3**	**LN**	**LIII**	**LK**	**Max**	**Min**
Phase-Neutral Voltage								
Phase-Phase Voltage								
Current								
Consumed Active Power								
Consumed Inductive Power								
Consumed Capacitive Power								
Consumed Apparent Power								
Consumed Power Factor (*)								
Consumed Cos Phi (*)								
Generated Active Power								
Generated Inductive Power								
Generated Capacitive Power								
Generated Apparent Power								
Generated Power Factor (*)								
Generated Cos Phi (*)								
Crest factor								
K - Factor								
Voltage THD								
Voltage THD even								
Voltage THD odd								
Current THD								
Current THD even								
Current THD odd								
Inst. Flicker (WA)								
PST Flicker								
Frequency								
Voltage Imbalance								
Voltage Asymmetry								
Current Imbalance								
Current Asymmetry								
Voltage Harmonics (1-50)								
Current Harmonics (1-50)								
Active Power Maximum Demand								
Apparent Power Maximum Demand								
Average Current Maximum Demand								
Current L1, L2, L3 Maximum Demand								
Consumed Active Energy								

Consumed Inductive Energy								
Consumed Capacitive Energy								
Consumed Apparent Energy								
Generated Active Energy								
Generated Inductive Energy								
Generated Capacitive Energy								
Generated Apparent Energy								
Wave shapes								
Phasor representation								

(*) The cosine and power factor angles have a default value of 1 if there are no variables for their calculation

THREE-PHASE CONNECTION 3 WIRES / ARON THREE-PHASE 3 WIRES								
Display Variables	**L1**	**L2**	**L3**	**LN**	**LIII**	**LK**	**Max**	**Min**
Phase-Neutral Voltage								
Phase-Phase Voltage								
Current								
Consumed Active Power								
Consumed Inductive Power								
Consumed Capacitive Power								
Consumed Apparent Power								
Consumed Power Factor (*)								
Consumed Cos Phi (*)								
Generated Active Power								
Generated Inductive Power								
Generated Capacitive Power								
Generated Apparent Power								
Generated Power Factor (*)								
Generated Cos Phi (*)								
Crest factor								
K - Factor								
Voltage THD								
Voltage THD even								
Voltage THD odd								
Current THD								
Current THD even								
Current THD odd								
Inst. Flicker (WA)								
PST Flicker								
Frequency								
Voltage Imbalance								
Voltage Asymmetry								
Current Imbalance								
Current Asymmetry								
Voltage Harmonics (1-50)								
Current Harmonics (1-50)								

Active Power Maximum Demand								
Apparent Power Maximum Demand								
Average Current Maximum Demand								
Current L1, L2, L3 Maximum Demand								
Consumed Active Energy								
Consumed Inductive Energy								
Consumed Capacitive Energy								
Consumed Apparent Energy								
Generated Active Energy								
Generated Inductive Energy								
Generated Capacitive Energy								
Generated Apparent Energy								
Wave shapes								
Phasor representation								

(*) The cosine and power factor angles have a default value of 1 if there are no variables for their calculation

TWO-PHASE CONNECTION								
Display Variables	**L1**	**L2**	**L3**	**LN**	**LIII**	**LK**	**Max**	**Min**
Phase-Neutral Voltage								
Phase-Phase Voltage								
Current								
Consumed Active Power								
Consumed Inductive Power								
Consumed Capacitive Power								
Consumed Apparent Power								
Consumed Power Factor (*)								
Consumed Cos Phi (*)								
Generated Active Power								
Generated Inductive Power								
Generated Capacitive Power								
Generated Apparent Power								
Generated Power Factor (*)								
Generated Cos Phi (*)								
Crest factor								
K - Factor								
Voltage THD								
Voltage THD even								
Voltage THD odd								
Current THD								
Current THD even								
Current THD odd								
Inst. Flicker (WA)								
PST Flicker								

Frequency								
Voltage Imbalance								
Voltage Asymmetry								
Current Imbalance								
Current Asymmetry								
Voltage Harmonics (1-50)								
Current Harmonics (1-50)								
Active Power Maximum Demand								
Apparent Power Maximum Demand								
Average Current Maximum Demand								
Current L1, L2, L3 Maximum Demand								
Consumed Active Energy								
Consumed Inductive Energy								
Consumed Capacitive Energy								
Consumed Apparent Energy								
Generated Active Energy								
Generated Inductive Energy								
Generated Capacitive Energy								
Generated Apparent Energy								
Wave shapes								
Phasor representation								

(*) The cosine and power factor angles have a default value of 1 if there are no variables for their calculation

SINGLE-PHASE CONNECTION								
Display Variables	**L1**	**L2**	**L3**	**LN**	**LIII**	**LK**	**Max**	**Min**
Phase-Neutral Voltage								
Phase-Phase Voltage								
Current								
Consumed Active Power								
Consumed Inductive Power								
Consumed Capacitive Power								
Consumed Apparent Power								
Consumed Power Factor (*)								
Consumed Cos Phi (*)								
Generated Active Power								
Generated Inductive Power								
Generated Capacitive Power								
Generated Apparent Power								
Generated Power Factor (*)								
Generated Cos Phi (*)								
Crest factor								
K - Factor								
Voltage THD								

Voltage THD even								
Voltage THD odd								
Current THD								
Current THD even								
Current THD odd								
Inst. Flicker (WA)								
PST Flicker								
Frequency								
Voltage Imbalance								
Voltage Asymmetry								
Current Imbalance								
Current Asymmetry								
Voltage Harmonics (1-50)								
Current Harmonics (1-50)								
Active Power Maximum Demand								
Apparent Power Maximum Demand								
Average Current Maximum Demand								
Current L1, L2, L3 Maximum Demand								
Consumed Active Energy								
Consumed Inductive Energy								
Consumed Capacitive Energy								
Consumed Apparent Energy								
Generated Active Energy								
Generated Inductive Energy								
Generated Capacitive Energy								
Generated Apparent Energy								
Wave shapes								
Phasor representation								

(*) The cosine and power factor angles have a default value of 1 if there are no variables for their calculation

18 SCREEN INFORMATION

Information about the analyzer screen and location of the various icons that appear on the upper bar of the analyzer menu are described below. Some icons change status based on programming, recording, memory or battery conditions.

18.1 UPPER BAR ICONS

The icons on the upper part of the screen indicate the status of the unit and are present on all screens. Each one's location on the screen and a brief description is shown in the figure

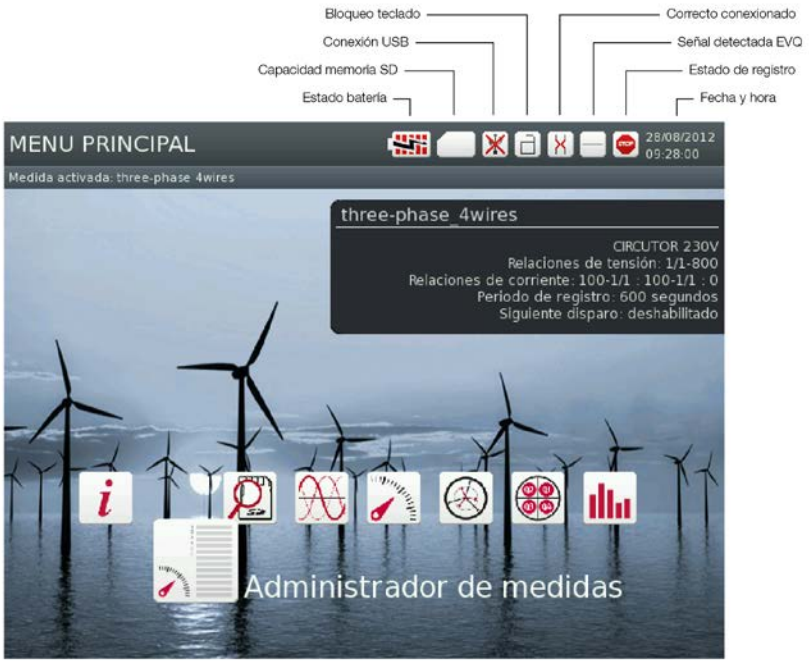


Fig.18-1.- Main screen

18.2 BATTERY CHARGE

The battery charge level is at its minimum. The user must immediately connect the auxiliary power supply.

The unit is being powered by the battery and this shows the battery charge status.

The unit is being powered by an auxiliary power supply and the battery is in the process of being charged.

18.3 BUTTON PAD LOCK

Indicates that the unit does not have the button pad password enabled

Indicates that the unit is locked with a password to prevent other users from changing its configuration.

18.4 PHASES CONNECTION

Indicates that the sequence of phases connected to the analyzer is correct.

Indicates that the unit has a possible connection area in the phases.

18.5 EVENT DETECTION

Indicates that the analyzer is not detecting any event or transient based on the configuration established by the user.

Indicates that the unit is detecting an event at the moment, based on the configuration established by the user.

Indicates that the detection and logging of quality events (EVQ) or transients events (TRN) has been automatically disabled.

18.5.1 Recording status

Indicates to the user that the analyzer is in display mode. This icon allows the unit configuration parameters to be modified.

REC indicates to the user that the unit is in recording mode.

Indicates that the unit has a trip (trigger) programmed to periodically perform an automatic logging.

There are three kinds of trip (trigger) conditions to obtain and log data.

NOTE: The trip function only operates when the analyzer is in the log (REC) mode.

- **Time interval trigger:** Log of electrical parameters is activated in a specific programmed time interval.
- **Periodic trigger:** Repetitive and periodic log of electrical parameters is activated in a specific programmed time interval.
- **Variable:** Log is activated when a specific variable meets a programmed trigger condition.

18.5.2 Memory capacity

Indicates that the internal memory of the analyzer is empty

Indicates that 60% of the unit's memory is free.

Indicates that the memory is full and the user must clear it in order to make new recordings.

18.5.3 USB connection

Indicates that the USB port of the unit is not activated.

Indicates that the unit has communications through the USB port enabled. In this status the unit does NOT allow data logging.

18.5.4 Photo

Indicates that the analyzer is in the process of capturing the instantaneous parameters and wave shapes of a photo.

18.6 MENU TREE

Menu tree navigation is performed by choosing the desired option using the ◄/► cursor buttons. Select the desired option from the menu and validate it by clicking the central button λ.

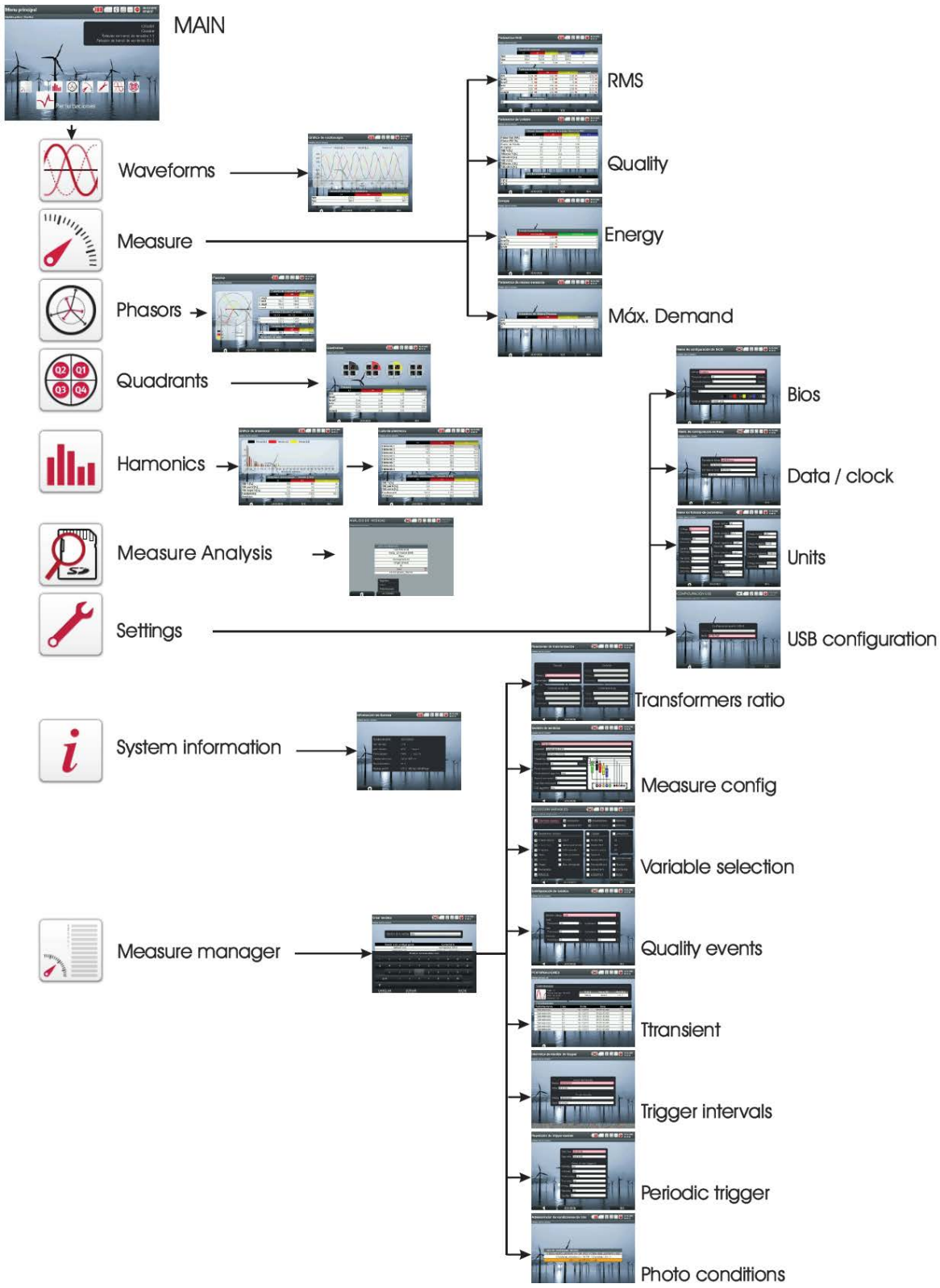


Fig.18-2.- Menu tree

18.7 SWITCHING OFF THE ANALYZER

To switch off the analyzer, press the POWER button. An alert message appears indicating that the system will shut down, allowing the user to confirm or cancel (Fig.18-3).

This alert also appears when the battery charge level is critical, and advises the user to connect the analyzer to the external power supply in order to charge the battery.

Fig.18-3.- Switch off alert message

19 TYPES OF FILES GENERATED

19.1 REC.STD FILES

This type of file stores logs with the average value of the variables for the configured logging time. The voltages and currents are indicated in RMS value. Each log also contains a wave shape capture for one cycle of all the channels. The variables logged in each capture vary depending on the configured connection type (three-phase 4 wire, three-phase 3 wire / three-phase 3 wire (Aron), two-phase or single-phase connections) and the user's selection (see the tables below).

⚠	The size of the REC files will vary in accordance with the parameters selected for logging. The file header has a size of 1,586 bytes and each logging (in 4 wire three-phase measuring with all the variables selected) occupies 4,230 bytes, for a total of 5,816 bytes≈ 6 kb

The variables for each connection type are shown in the following tables.

THREE PHASE 4 WIRES CONNECTION								
STD recording variables	**L1**	**L2**	**L3**	**LN**	**LIII**	**LK**	**Máx**	**Mín**
Phase-Neutral Voltage	X	X	X	X	X		X	X
Phase-Phase Voltage	X	X	X		X		X	X
Current	X	X	X	X	X	X	X	X
Consumed Active Power	X	X	X		X		X	X
Consumed Inductive Power	X	X	X		X		X	X
Consumed Capacitive Power	X	X	X		X		X	X
Consumed Apparent Power	X	X	X		X		X	X
Consumed Power Factor	X	X	X		X		X	X
Consumed Cos Phi	X	X	X		X		X	X
Generated Active Power	X	X	X		X		X	X
Generated Inductive Power	X	X	X		X		X	X
Generated Capacitive Power	X	X	X		X		X	X
Generated Apparent Power	X	X	X		X		X	X
Generated Power Factor	X	X	X		X		X	X
Generated Cos Phi	X	X	X		X		X	X
Crest factor	X	X	X				X	X
K Factor	X	X	X				X	X
Voltage THD	X	X	X	X			X	X
Current THD	X	X	X	X			X	X
Inst. Flicker (WA)	X	X	X	X				
PST Flicker	X	X	X	X				
Frequency	X						X	X
Voltage Imbalance					X		X	X
Voltage Asymmetry					X		X	X
Current Imbalance					X		X	X
Current Asymmetry					X		X	X
Voltage Harmonics (1-50)	X	X	X	X				
Current Harmonics (1-50)	X	X	X	X				
Active Power Maximum Demand					X			
Apparent Power Maximum Demand					X			
Average Current Maximum Demand					X			
Current L1, L2, L3 Maximum Demand	X	X	X					
Consumed Active Energy					X			
Consumed Inductive Energy					X			
Consumed Capacitive Energy					X			
Consumed Apparent Energy					X			
Generated Active Energy					X			
Generated Inductive Energy					X			
Generated Capacitive Energy					X			
Generated Apparent Energy					X			

THREE PHASE 3 WIRES or THREE PHASE 3 WIRES ARON CONNECTIONS								
STD recording variables	**L1**	**L2**	**L3**	**LN**	**LIII**	**LK**	**Máx**	**Mín**
Phase-Neutral Voltage								
Phase-Phase Voltage	X	X	X		X		X	X
Current	X	X	X		X	X	X	X
Consumed Active Power	X	X	X		X		X	X
Consumed Inductive Power	X	X	X		X		X	X
Consumed Capacitive Power	X	X	X		X		X	X
Consumed Apparent Power	X	X	X		X		X	X
Consumed Power Factor	X	X	X		X		X	X
Consumed Cos Phi	X	X	X		X		X	X
Generated Active Power	X	X	X		X		X	X
Generated Inductive Power	X	X	X		X		X	X
Generated Capacitive Power	X	X	X		X		X	X
Generated Apparent Power	X	X	X		X		X	X
Generated Power Factor	X	X	X		X		X	X
Generated Cos Phi	X	X	X		X		X	X
Crest factor	X	X	X				X	X
K Factor	X	X	X				X	X
Voltage THD	X	X	X				X	X
Current THD	X	X	X				X	X
Inst. Flicker (WA)	X	X	X					
PST Flicker	X	X	X					
Frequency	X						X	X
Voltage Imbalance					X		X	X
Voltage Asymmetry					X		X	X
Current Imbalance					X		X	X
Current Asymmetry					X		X	X
Voltage Harmonics (1-50)	X	X	X					
Current Harmonics (1-50)	X	X	X					
Active Power Maximum Demand					X			
Apparent Power Maximum Demand					X			
Average Current Maximum Demand					X			
Current L1, L2, L3 Maximum Demand	X	X	X					
Consumed Active Energy					X			
Consumed Inductive Energy					X			
Consumed Capacitive Energy					X			
Consumed Apparent Energy					X			
Generated Active Energy					X			
Generated Inductive Energy					X			
Generated Capacitive Energy					X			
Generated Apparent Energy					X			

TWO PHASE CONNECTION								
STD recording variables	**L1**	**L2**	**L3**	**LN**	**LIII**	**LK**	**Máx**	**Mín**
Phase-Neutral Voltage	X	X		X	X		X	X
Phase-Phase Voltage	X				X		X	X
Current	X	X		X	X	X	X	X
Consumed Active Power	X	X			X		X	X
Consumed Inductive Power	X	X			X		X	X
Consumed Capacitive Power	X	X			X		X	X
Consumed Apparent Power	X	X			X		X	X
Consumed Power Factor	X	X			X		X	X
Consumed Cos Phi	X	X			X		X	X
Generated Active Power	X	X			X		X	X
Generated Inductive Power	X	X			X		X	X
Generated Capacitive Power	X	X			X		X	X
Generated Apparent Power	X	X			X		X	X
Generated Power Factor	X	X			X		X	X
Generated Cos Phi	X	X			X		X	X
Crest factor	X	X					X	X
K Factor	X	X					X	X
Voltage THD	X	X		X			X	X
Current THD	X	X		X			X	X
Inst. Flicker (WA)	X	X		X				
PST Flicker	X	X		X				
Frequency	X						X	X
Voltage Imbalance					X		X	X
Voltage Asymmetry					X		X	X
Current Imbalance					X		X	X
Current Asymmetry					X		X	X
Voltage Harmonics (1-50)	X	X		X				
Current Harmonics (1-50)	X	X		X				
Active Power Maximum Demand					X			
Apparent Power Maximum Demand					X			
Average Current Maximum Demand					X			
Current L1, L2, L3 Maximum Demand	X	X						
Consumed Active Energy					X			
Consumed Inductive Energy					X			
Consumed Capacitive Energy					X			
Consumed Apparent Energy					X			
Generated Active Energy					X			
Generated Inductive Energy					X			
Generated Capacitive Energy					X			
Generated Apparent Energy					X			

SINGLE PHASE CONNECTION								
STD recording variables	**L1**	**L2**	**L3**	**LN**	**LIII**	**LK**	**Máx**	**Mín**
Phase-Neutral Voltage	X			X	X		X	X
Phase-Phase Voltage								
Current	X			X	X	X	X	X
Consumed Active Power	X				X		X	X
Consumed Inductive Power	X				X		X	X
Consumed Capacitive Power	X				X		X	X
Consumed Apparent Power	X				X		X	X
Consumed Power Factor	X				X		X	X
Consumed Cos Phi	X				X		X	X
Generated Active Power	X				X		X	X
Generated Inductive Power	X				X		X	X
Generated Capacitive Power	X				X		X	X
Generated Apparent Power	X				X		X	X
Generated Power Factor	X				X		X	X
Generated Cos Phi	X				X		X	X
Crest factor	X						X	X
K Factor	X						X	X
Voltage THD	X			X			X	X
Current THD	X			X			X	X
Inst. Flicker (WA)	X			X				
PST Flicker	X			X				
Frequency	X						X	X
Voltage Imbalance					X		X	X
Voltage Asymmetry					X		X	X
Current Imbalance					X		X	X
Current Asymmetry					X		X	X
Voltage Harmonics (1-50)	X			X				
Current Harmonics (1-50)	X			X				
Active Power Maximum Demand					X			
Apparent Power Maximum Demand					X			
Average Current Maximum Demand					X			
Current L1, L2, L3 Maximum Demand	X							
Consumed Active Energy					X			
Consumed Inductive Energy					X			
Consumed Capacitive Energy					X			
Consumed Apparent Energy					X			
Generated Active Energy					X			
Generated Inductive Energy					X			
Generated Capacitive Energy					X			
Generated Apparent Energy					X			

19.2 PHO.STD FILE

This kind of file contains logs of the instantaneous electrical parameters measured by the analyzer during a network cycle. A photo trip may be caused by:

- ***Manual trip***: All data display screens allow a photo to be taken manually using the PHOTO option of the ACTIONS menu.
- ***Trip due to a photo condition***: The trip condition is usually connected to a variable value.

In a PHOTO.STD file the instrument stores various “photos” made in the same measurement set of files. In each “photo”, all variables measured by the AR6 are logged instantaneously, along with one cycle wave shape of all input channels.

	The PHO file header has a size of 1,222 bytes and each logging (in 4 wire three-phase measuring with all the variables selected) occupies 3,478 bytes, for a total of 4,700 bytes≈ 5 kb

19.3 EQV.STD FILE

This file type contains logs of quality events in any of the 3 voltage channels L1, L2, or L3. Events detection can be configured to detect.

Voltage sags
Swells
Voltage interruptions

The various events that are detected in the electrical network being analysed are stored in this file. The following data is stored from each one of the events.

- ***Date of Event:*** This is the date the event occurred. This value is obtained with a 1 cycle accuracy.
- ***Event type:*** The event is stored if it is an interruption, a sag, or a swell in the limits defined in setup of the AR6. The record indicates the phase in which it occurred,
- ***Duration of the Event:*** Duration in milliseconds.
- ***Minimum and maximum voltage of the Event:*** When an interruption or sag is produced, the minimum RMS½***** voltage value obtained during the event is stored. The maximum value will be saved if the event is a swell.
- ***Mean voltage of the Event:*** This is the average of RMS½***** voltages during the duration of the transient.
- ***Voltage previous to the Event:*** The RMS½***** voltage value just before the event started.
- ***Wave shape from 2 cycles of the event:*** The analyzer stores a record of the half cycle previous to the detection of the event. The record finishes one-half cycles after the event has finished. This leaves it perfectly delimited, shows its complete course and allows a full analysis.

The RMS½ Value***** is the RMS value of a voltage or current, re-calculated every half cycle, in accordance with EN 61000-4-30

	The EVQ file header has a size of 234 bytes and each log (in 4 wire three-phase measuring with all the variables selected) occupies 2,094 bytes, for a total of 2,328 bytes≈ 3 kb

19.4 LOG.EVA FILES

The AR6 analyzer has a log type called EVA in which the device's events are stored. A device event is understood as any change of the measurement configuration that affects the header of STD files, such as switching the unit ON or OFF, modifying the transformer's ratios, battery charge status, deleting maximum values or other parameters. The complete list of events is shown in Table 19-1.

Table 19-1.- Table of variables for LOG.EVA files

Event Name	Description
BAT_OFF	Battery level that causes the unit to switch off.
CLEAR_ENERGY	Deleting energy.
CLEAR_MAX_MIN	Deleting maximum values, minimum values or maximum and minimum values.
CLEAR_MAX_DEMAND	Deleting maximum demand.
SETUP_CHANGED	Change of a configuration parameter other than transformer's ratios
SETUP_TRANS_RATIO _CHANGED	Change of transformer's ratio configurations
SETUP_TIME_CHANGED	Change of date and/or time
TRIGGER_ON	Entering in a trip time window (associated with the immediate subsequent generation of the REC_START event)
TRIGGER_OFF	Exiting a trip time window (associated with the immediate subsequent generation of the REC_STOP event)
DELETED_STD_FILE	Deleting configuration files due to erasing a measurement
POWER_ON	Unit switched on
POWER_OFF	Unit switched off
REC_STOP	Stop manual or trip logging
REC_START	Start manual or trip logging
TRIGGER_CONDITION_ON	Trip activation due to a variable condition
TRIGGER_CONDITION_OFF	Trip deactivation due to a variable condition
EVQ_STOP	Automatic deactivation of events or transients (after detecting 1 EVQ / TRN per second for 15 sec.)
EVQ_START	Automatic enabling of events or transients (after 10 min. has elapsed since deactivation)

19.5 LOGS LOCATION

The recorded files are located in the internal memory of the analyzer, in the subdirectory DB_Measures.
Subdirectories as well as measurements/configurations that may have been created are all found in this subdirectory.
The AR6 analyzer always measures, calculates and records according to an active measurement configuration (see CONFIGURATION), thus the recording files stored in the subdirectory corresponding to the measurement active at the time of recording.

19.6 FILE DOWNLOADING

- Switch on the analyzer and enable the analyzer's USB port communication using the USB Configuration function.
- Connect the analyzer to the PC using the supplied USB cable and the computer will detect the analyzer and recognise it as an external drive.
- Recover the files from the corresponding measurement file on the external drive unit.

	Do not leave the USB activation screen to communicate with the analyzer as the unit modifies the port configuration when the user exits this screen.

20 SOFTWARE UPDATE

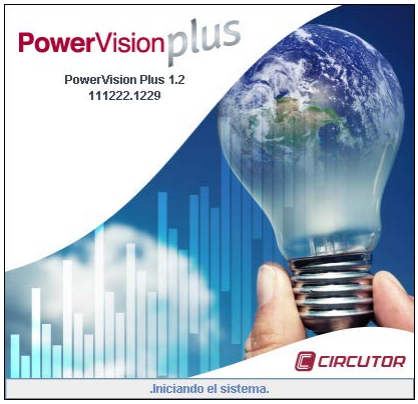
	Updating removes *.EVQ, *.PHO and *.REC files due to a change in its their internal structure. Make sure to copy the data stored on the memory before the user update the analyzer.

To update the AR6 analyzer the user must download the firmware version from the CIRCUTOR web site: http://www.circutor.es/noticias/ar6-new-firmware_n_1046.aspx

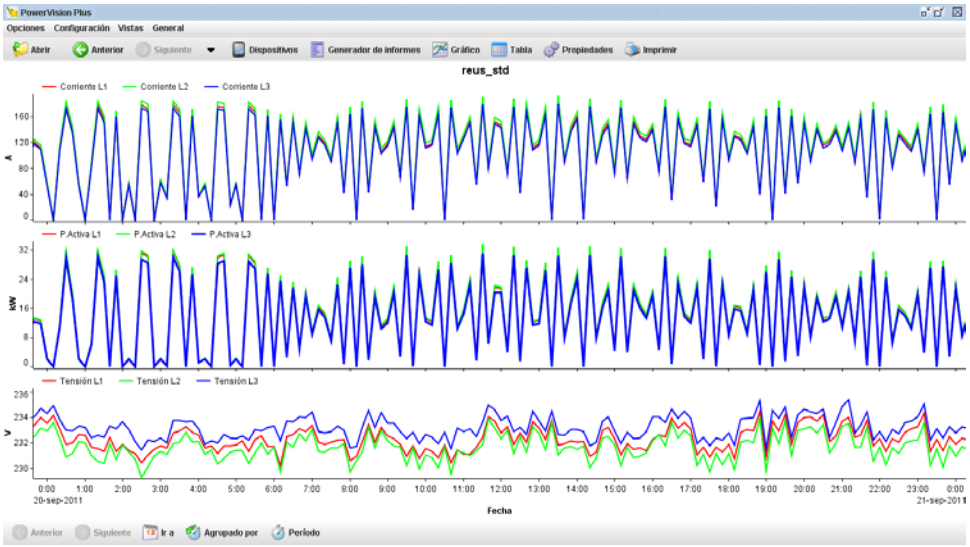
Follow the steps indicated in the update manual. The steps may vary depending on the unit version.

21 POWER VISION PLUS

Power Vision Plus is the software that lets the user download and manage the data logged by the AR6 network analyzer.



It is a tool that helps users the analysis of data through graphics and tables.



Power Vision Plus is an essential tool to run reports and audits as it lets the user export the images and attach them to documents.

For more information, download the full Power Vision Plus manual from the CIRCUTOR website: www.circutor.es

22 FREQUENTLY ASKED QUESTIONS

22.1 CAN I EXPAND THE ANALYZER'S INTERNAL MEMORY?

Users can expand the unit's memory capacity by changing the SD. The SD must have FAT32 format and may have up to 32 Gb of capacity.

22.2 THE UNIT IS NOT RESPONDING TO THE BUTTONS. WHAT COULD BE HAPPENING AND HOW CAN I FIX IT?

Generally the locking is caused by clicking a sequence of buttons that lock it out. To unlock the buttons, briefly press the unit's off button. The unit will then respond to all buttons.

22.3 WHAT DOES THE UNIT LOG WHEN IT TAKES A SNAPSHOT?

The analyzer logs 1 wave shape cycle of the 9 channels with resolution of 128 samples per channel, as well as the RMS values of the instantaneous, variables, harmonics, phasors and energy. Maximum and minimum values, quality parameters and maximum demand.

22.4 WHAT DOES IT LOG WHEN IT CAPTURES THE WAVE SHAPE OF AN EVENT?

It logs 2 wave shape cycles, ½ of the previous cycle and 1½ cycles after the detection of the event, with a resolution of 128 samples per channel.

22.5 WHAT SOFTWARE IS USED TO ANALYSE THE LOGGED DATA?

The data is downloaded and analysed with the Power Vision Plus software that comes with the unit.

23 MAINTENANCE AND TECHNICAL SERVICE

In the case of any query in relation to unit operation or malfunction, please contact the **CIRCUTOR, SA** Technical Assistance Service.

CIRCUTOR Technical Assistance Service (TAS)
Vial Sant Jordi, s/n 08232 - Viladecavalls (Barcelona)
Tel.: 902 449 459 (Spain) / +34 937 452 900 (outside of Spain)
e-mail: sat@circutor.es
WEBSITE: www.circutor.es

24 GUARANTEE

CIRCUTOR guarantees its products against any manufacturing defect for two years after the delivery of the unit.

CIRCUTOR will repair or replace any defective factory product returned during the guarantee period.

- No returns will be accepted and no unit will be repaired or replaced if it is not accompanied by a report indicating the defect detected or the reason for the return.
- The guarantee will be void if the unit has been improperly used or the storage, installation and maintenance instructions listed in this manual have not been followed. "Improper usage" is defined as any operating or storage condition contrary to the National Electrical Code or that surpassing the limits indicated in the technical and environmental features of this manual.
- **CIRCUTOR** accepts no liability due to the possible damage to the unit or other parts of the installation, nor will it cover any possible sanctions derived from a possible failure, improper installation or "improper usage" of the unit. Consequently, this guarantee does not apply to failures occurring in the following cases:

  - Swells and/or electrical disturbances in the supply;
  - Water, if the product does not have the appropriate IP classification;
  - Poor ventilation and/or excessive temperatures;
  - Improper installation and/or lack of maintenance;
  - Buyer repairs or modifications without the manufacturer's authorisation.

25 CE certification

CIRCUTOR
VIAL SANT JORDI, S/N
08232 VILADECAVALLS (BARCELONA)
ESPAÑA / SPAIN

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Tel: (+34) 93 745 29 00
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DECLARACION DE CONFORMIDAD CE
CE DECLARATION OF CONFORMITY
DECLARATION DE CONFORMITE CE

Por la presente **CIRCUTOR, S.A.**
We hereby
Par le présent

Con dirección en: **Vial Sant Jordi, s/n**
With address in: **08232 VILADECAVALLS (Barcelona)**
Avec adresse à: **ESPAÑA**

Declaramos bajo nuestra responsabilidad que el producto:
We declare under our responsibility that the product:
Nous déclarons sous notre responsabilité que le produit:

Analizador de redes eléctricas **Serie: AR6**

Marca CIRCUTOR

Siempre que sea instalado, mantenido y usado en la aplicación para la que ha sido fabricado, de acuerdo con las normas de instalación aplicables y las instrucciones del fabricante,
Provided that it is installed, maintained and used in application for which it was made, in accordance with relevant installation standards and manufacturer's instructions,
Toujours qu'il soit installé, maintenu et utilisé pour l'application par lequelle il a été fabriqué, d'accord avec les normes d'installation applicables et suivant les instructions du fabricant,

Cumple con las prescripciones de la(s) Directiva(s):
Complies with the provisions of Directive(s):
Accomplie avec les prescriptions de la (les) Directive(s):

2006/95/CE
2004/108/CE
2006/42/CE

Está en conformidad con la(s) siguiente(s) norma(s) u otro(s) documento(s) normativo(s) :
It is in conformity with the following standard(s) or other normative document(s) :
Il est en conformité avec la (les) norme(s) suivante(s) ou autre(s) document(s) normatif (ves) :

IEC 61010-1 :2001
IEC 61000-6-3 :2006
IEC 61000-6-1 :2005

Año de colocación del marcado "CE": 2010
Year of affixing "CE" marking:
An de mise en application du marquage "CE":

Revisado en Viladecavalls
Fecha:02/03/2010

Nombre y Firma :
Name and signature :
Nom et signature :

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Francisco Rosique Gil
General Manager